TM 1-460

WAR DEPARTMENT

TECHNICAL MANUAL

RADIOTELEPHONE PROCEDURE ARMY AIR FORCES

March 31, 1942

TECHNICAL MANUAL
No. 1-460

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RADIOTELEPHONE PROCEDURE, ARMY AIR FORCES

SECTION I

GENERAL

*This manual supersedes TM 1-460, March 21, 1941.

445690°—42——1

1. General.—*a.* The purpose of this manual is to acquaint Army Air Force radio operators and pilots with radiotelephone procedure. The procedure herein is sufficient for satisfactory voice communication with the various radio services that the radio operator or pilot may wish to contact.

b. Such items as weather reports, facility charts, radio ranges, etc., though they cannot be called procedure, are nevertheless necessary in order that the radio operator in flight may be sufficiently familiar with these items so as to provide satisfactory communication service.

c. A section is devoted to airport control tower procedure (sec. V). This is included in order to familiarize enlisted men with such procedure in case they are detailed to duty as airport control tower operators. It also serves as a guide for pilots who may wish to review control tower procedure.

d. This procedure is not meant to replace FM 24-10 or TM 11-454. It is prescribed for nontactical communication with various radio services.

2. Enunciation.—Correct understanding of speech over the radio must be effected through good, clear enunciation. Loud talking into the microphone is unnecessary. The normal tone of voice should be used. The gain control on the transmitter will raise or lower the voice to the proper modulation level. Reading aloud at home or in a deserted corner of the barracks is an excellent form of practice. Consideration of the enunciation of others will prove interesting as well as instructive.

3. Continuity.—A uniform flow of language without hesitation is necessary in order that each word may be heard with equal strength. The position and distance of the speaker from the microphone should not be changed during a transmission. If for any reason it becomes

necessary for the operator to change his position or turn his head, speech should be suspended until the proper position has been resumed. Each syllable should be enunciated clearly, and numerals especially should be spoken distinctly. A slight pause between the word preceding and following numerals accentuates the figure which is the vital information intended for the pilot.

4. Speech rate.—Radiotelephone transmissions will be performed at a rate which if necessary will permit the receiving operator to copy the transmission verbatim. Stations of the Civil Aeronautics Administration (CAA) transmit scheduled broadcasts at a rate of 120 words per minute.

5. Superfluous transmissions.—A radio frequency channel is equivalent to a telephone in many respects but is more susceptible to interference and enemy interception. Unnecessary transmissions will be avoided in order to minimize those possibilities. Radiotelephone transmissions will be made in a concise and business-like manner and in a normal conversational tone of voice without undue fluctuation. Only official transmissions will be made. Operators will refrain from personal remarks which have no bearing on the message or messages being transmitted.

6. Corrections.—Occasionally an operator may make a mistake in reading reports or information into a microphone. If this happens, the erroneous report must be corrected before continuing. Speech should be stopped immediately, the word "Correction" spoken, and the correct version of what was to be said should be stated. If necessary, the whole sentence should be repeated in order that the receiving operator may receive all the information intended for him, thus: "A formation of seventy-five aircraft will pass—correction—A formation of one hundred seventy-five aircraft will pass," etc.

7. Repetitions.—If the operator did not receive the information intended for him, he will call the station and ask for a repetition, thus: "Repeat all"; "Repeat all after ———"; "Repeat ———." (Dash line indicates any missing portion.)

8. Stand by.—If the transmitting operator finds that he is unable to continue with his transmission, or if he desires the receiving operator to stand by for further transmission, he will advise the receiving operator to wait for further transmissions simply by saying, "Wait." If the transmitting operator can determine the time when he will again be prepared to transmit, he may request the receiving operator to "Wait 1 minute"; "Wait 5 minutes"; or whatever time he estimates will be necessary for him to continue with the transmission of messages or other information.

9. Receipt.—The word "Roger" will be utilized by a receiving station to receipt for a radiotelephone message. "Roger" is the phonetic equivalent of the letter "R," which in radiotelegraphy means "Received." This explanation is made to clear up some of the mysteries surrounding the origin of "Roger." As an example, a ship receipts for a weather report it has received from the St. Louis radio range station, thus: "ROGER."

10. Profanity.—The use of profanity and obscene language on the air is forbidden. It is both a court-martial and a Federal offense. (See par. 103.)

11. Calls.—To establish communication, the initial call-up will be made once as indicated in the example below. If no reply is heard within 30 seconds, a second call-up is made, this time the call-up is made twice. The double call-up will be repeated at 1-minute intervals until communication is established. If no reply is heard, the operator will use good judgment as to whether or not he should continue calling.

Item	*Example*
Designation of station called	"SCOTT ARMY AIRWAYS"
The word "From"	"FROM"
Designation of calling station	"EIGHT FIVE ZERO SIX"
Invitation to reply	"GO AHEAD"

12. Invitation to reply.—At the end of each call or message, it is necessary for the transmitting operator to notify the receiving operator when it is his turn to transmit. The phrase "Go ahead" will terminate a transmission and advise the receiving operator to go ahead with his reply. If no such means were used, the receiving operator would have no way of knowing whether the transmitting operator was finished with his transmission or just merely pausing for a moment. The use of "Go ahead" definitely indicates that the transmitting operator is finished and expects an answer.

13. Advice of compliance.—*a.* The phrase contraction "Wilco" means "Will comply." "Wilco" will not normally be used by operators in receipting for messages because most messages are addressed to persons other than operators, and an operator cannot very well acknowledge to carry out orders addressed to another person. However, operators may use the expression if the message concerns themselves, such as adjusting equipment, changing frequency, making tests, etc. "Wilco" is best adapted for use of pilots in acknowledging that they will carry out landing, take-off, or other instructions. When "Wilco" is used it is sufficient acknowledgment and when so used takes the place of "Roger."

b. Example of use of "Wilco":

Tower: "Taxi to north end of north-south runway and take off when ready, go ahead."
Plane: "WILCO."

c. In the above example, the words "Go ahead" do not mean to go ahead and taxi to the runway. "Go ahead" is simply an indication of the end of the message and a reply is requested. The instructions are contained in the sentence preceding the words "Go ahead." The instructions are acknowledged, and the pilot indicates that he will comply with the instructions issued.

14. Procedure after communication is established.—After communication is established, station identification may be omitted for the duration of the contact, providing there is no possibility of confusion or misdirecting of messages. Stations concerned may talk back and forth as though on a wire telephone circuit except that each time the transmitting operator is finished talking for the moment, and desires a reply before continuing, he will terminate his transmission with "Go ahead."

15. Termination of communication.—The phrase "That is all" may be used to indicate that the communication is completed. Most communications are of such a nature that there is no doubt about their completion. If however, there is any doubt as to whether or not the contact is completed, either party may initiate the phrase "That is all," indicating that he is definitely finished and has nothing more to say.

16. Reopening of communication.—Reopening of communications, once closed, requires a new call-up. This is necessary even though less than a minute may have elapsed since termination of contact.

17. Statement of figures.—*a.* All figures will be spoken individually except those utilized to indicate ceiling heights, flight levels, upper air levels, etc. Those figures will be spoken in even hundreds and thousands of feet.

b. Examples of figure statements:

Number	Statement
500	Five hundred.
1,300	One thousand and three hundred.
4,500	Four thousand and five hundred.
10,000	Ten thousand.
13,000	Thirteen thousand.
18,143	One eight one four three.
22,000	Twenty two thousand.

18. Statement of time.—*a.* Time will be stated in exactly four figures utilizing the 24-hour clock. The hour will be stated by the first two figures and the minutes by the last two figures. Midnight is 0000 or 2400. The last hour of the 24-hour clock day begins at 2300. The last minute of the last hour begins at 2359 and ends at 0000, which is the beginning of the first minute ending at 0001 of the first hour of the next day.

b. Examples of statement of time:

Time	Statement
0000 (midnight)	Zero zero zero zero.
0920 (9:20 AM)	Zero nine two zero.
1200 (noon)	One two zero zero.
1643 (4:43 PM)	One six four three.
2347 (11:47 PM)	Two three four seven.

Section II

WEATHER REPORTS

19. General.—The safety of air navigation depends very much on weather conditions. Poor visibility and low ceilings are the pilot's greatest hazards. Before departing for a particular destination it is essential that the pilot know existing weather conditions en route and at his destination.

20. Schedule of observations.—The Civil Aeronautics Administration and the United States Weather Bureau operate and maintain weather reporting stations throughout the United States. These stations are linked by teletype circuits. All stations make a weather observation and transmit it on the teletype circuit 30 minutes after each hour throughout the day and night.

21. Special weather reports.—In addition to hourly reports, the station reports important changes in weather by means of a special weather report which is transmitted as soon as possible on the teletype circuit. The actual changes and limitations are beyond the scope of this manual. A special weather report is mentioned to acquaint the student with the fact that a change of some sort has taken place. By watching the reports from a particular station, the changes will be noted by either addition or omission of information in the previous report.

22. Requirements of radio operator.—An Army Air Force radio operator is required to know enough about weather symbols and regulations to copy intelligently weather information as broadcast by radio range stations, Army airways stations, control towers, or any other source. In addition, he must be able to take weather reports off a teletype circuit and broadcast them at a rate of 120 words per minute plus or minus 5 percent. The speed will not be below the minimum of 114 words per minute, nor will it exceed a maximum of 126 words per minute.

23. Composition of weather report.—Paragraphs 24 to 45, inclusive, describe each item of a weather report in the order in which it appears in the report.

24. Station designator.—Combinations of two or three letters are used as station designators. The designator indicates that the weather report following it originated at that station. For a list of station designators see appendix IX.

25. Classification symbol.—All weather observations made at controlled airports will be classified according to the following limits:

a. "C"—pronounced "Contact." Weather reports containing this symbol are often referred to as "Class C weather reports" or "Class C weather." For contact weather the ceiling must be 1,000 feet or more, and the visibility must be 3 miles or more.

b. "N"—pronounced "Instrument." Weather reports containing this symbol are often referred to as "Class N weather reports" or "Class N weather." Weather conditions indicated by this symbol are below that for class C minimums but not below 500 feet ceiling and/or 1 mile visibility.

c. "X"—pronounced "Closed." Weather reports containing this symbol are often referred to as "Class X weather reports" or "Class X weather." Weather conditions indicated by this symbol are below 500 feet ceiling and/or 1 mile visibility.

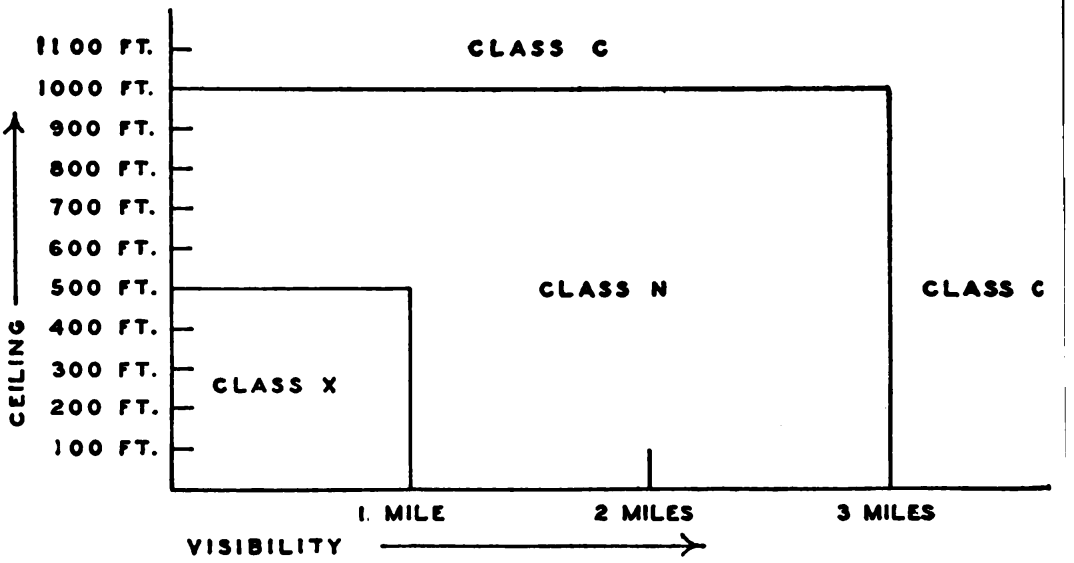


FIGURE 1.—Classification chart.

26. Explanation of classification chart (fig. 1).—If either the ceiling or the visibility falls below the minimum for one of the classes, the weather report will be given the lowest classification. For example, ceiling 5,000 feet, visibility 2 miles, will be classed as instrument (N).

27. Reasons for classification.—Pilots on the ground or in flight, and airline companies, will depend upon and be guided by the classification of weather conditions and will make flight plans and dispatch airplanes accordingly, or may need to change or alter plans already made if the classification in airway weather sequences changes. It is the responsibility of personnel giving out weather reports orally to pilots and others to make certain that the classification of the report or reports is distinctly and clearly given and that there is no misunder-

standing on the part of the inquirer which may lead to later confusion or difficulty. During contact weather all persons may take off or land without any special equipment or qualifications, providing of course that they abide by the Civil Air Regulations. During instrument weather, it is necessary that the pilot be rated as an instrument pilot and that the ship is equipped with the necessary instruments, including two-way radio, to make a flight safely under instrument weather conditions. Class X weather indicates a closed airport. This does not mean that the airport is closed to all air traffic. Government and scheduled airline aircraft may continue to land and take off. Landings and take-offs are suspended to all other aircraft except that the control tower operator may authorize a departure provided that the ceiling is not less than 300 feet and the visibility is not less than ½ mile, and also provided that such airport is equipped with a radio directional aid to air navigation.

28. Ceiling.—This item follows the classification symbol and is the first item in the weather report proper. The ceiling as pertains to weather is the height in feet above the station reporting of the base of the lowest layer of broken or overcast clouds. Scattered clouds do not constitute a ceiling. If more than one layer of clouds is observed and reported, the base of the lower clouds is the ceiling. The ceiling is indicated to the nearest 100 feet up to 5,000 feet, and above that to the nearest 500 feet up 9,750 feet above the station. On a teletype weather report the height is indicated in hundreds of feet.

29. Sky symbols.—There are four basic sky symbols, often called cloud symbols. These symbols with corresponding pronunciations and limitations are as follows:

○ "Clear"—Sky either clear of clouds or partly covered by clouds. The maximum amount of sky that can be covered by clouds is less than one tenth.

◔ "Scattered clouds"—From one-tenth to five-tenths, inclusive, of sky covered by clouds.

◕ "Broken clouds"—More than five-tenths but not more than nine-tenths of sky covered by clouds.

⊕ "Overcast"—More than nine-tenths of sky covered by clouds.

Example:

40⊕12 ◔ "Ceiling 4,000 feet, overcast, lower scattered clouds at 1,200 feet."

30. Ceiling unlimited.—*a*. The ceiling will be unlimited when—

(1) The sky is clear.

(2) There are scattered clouds only.

(3) The base of the overcase or broken clouds is more than 9,750 feet above the point of observation.

(4) There is a combination of conditions (2) and (3) above.

(5) When the ceiling is unlimited, the figures indicating the height of the ceiling are omitted from the report. For broadcasting or other announcements of weather reports, if the ceiling is unlimited it is not mentioned.

b. Examples:

NK C ○ "Newark, contact, clear." etc.
LS N 7⊕ "St. Louis, instrument, ceiling seven hundred, overcast." etc.
CC C 25◑ "Cincinnati, contact, scattered clouds at two thousand five hundred."

31. Modifying signs for ceiling.—*a.* When the number itself appears indicating the height of ceiling, it indicates that the ceiling has actually been measured. Example:

23⊕ "Ceiling 2,300 feet (measured)."

b. When the letter "E" precedes the figure indicating height of ceiling, it means that the ceiling has been estimated by the weather observer. Example:

E65 ◍ "Ceiling estimated six thousand five hundred, broken clouds."

c. When the letter "V" follows the ceiling value, it indicates that the height of the ceiling is variable. The modifying symbol "V" is used only when the ceiling is 2,000 feet or less. When the ceiling is more than 2,000 feet, variations are not reported. Example:

E5 V⊕ "Ceiling estimated five hundred, variable, overcast."

d. When the plus sign precedes the height of ceiling, it indicates that the ceiling is more than the figure given. Often a ceiling balloon is blown out of sight before it enters the clouds. The height of the balloon when last observed will be reported. Example:

+18⊕ "Ceiling more than one thousand eight hundred, overcast."

32. Modifying signs for sky symbols.—*a.* The slant (/) following a cloud symbol indicates high clouds, that is, those more than 9,750 feet above the point of observation.

b. The plus sign preceding a cloud symbol indicates dark clouds.

c. The minus sign preceding a cloud symbol indicates thin clouds.

d. Examples:

◍/ "High broken clouds."
8+⊕ "Ceiling eight hundred, dark overcast."
50−◑ "Thin scattered clouds at five thousand."
−⊕/ "High thin overcast."

33. Reporting more than one layer of clouds.—When two layers of clouds are observed they will be reported and broadcast as follows:

25⊕/◐ "Ceiling two thousand five hundred, high overcast, lower broken clouds."

a. The higher layer of clouds is more than 9,750 feet above the point of observation and the lower layer is below this level. The base of the lower level is indicated as the ceiling.

◑/15◑ "High scattered, lower scattered clouds at one thousand five hundred."

b. The higher layer is above 9,750 feet and the lower layer is reported in hundreds of feet. In this case there is no ceiling. It is unlimited and because of this it is not mentioned during broadcasts or announcements.

40◐◐ "Ceiling four thousand, broken, lower broken clouds."

c. The higher layer of clouds is below 9,750 feet and the lower layer is indicated as the ceiling.

d. Several combinations of sky symbols will be found in appendix IV.

34. Visibility.—"Visibility" as defined by the Weather Bureau is the mean greatest distance toward the horizon that prominent objects such as mountains, buildings, towers, etc., can be seen and identified by the normal eye unaided by special optical devices, such as binoculars, telescopes, glare-eliminating goggles, etc., and which distance must prevail over a range of half or more of the horizon.

35. Reporting visibility.—*a.* Visibility is the next item in a weather report immediately following the sky conditions, and will be reported as follows:

0	Zero.	2	Two.
⅛	One eighth	2¼	Two and one quarter.
⅕	One fifth.	2½	Two and one half.
¼	One quarter.	3	Three.
½	One half.	4	Four.
¾	Three quarters.	5	Five.
1	One.	6	Six.
1¼	One and one quarter.	7	Seven.
1½	One and one half.	8	Eight.
1¾	One and three quarters.	9	Nine.

b. If the visibility is less than 2 miles and varies so that a definite figure cannot be given, the visibility at time of observation is reported, followed by the letter "V."

c. If the visibility is more than 9 miles it will be omitted from a weather report and will not be mentioned in broadcasts or announcements.

d. Examples:

50⊕6	"Ceiling five thousand, overcast, visibility six."
E25◐11/2V	"Ceiling estimated two thousand five hundred, broken clouds, visibility one and one half, variable."
⊕/9	"High overcast, visibility nine."
+17◐	Ceiling more than one thousand seven hundred, broken clouds."

In the last report the visibility is more than 9 miles because it is omitted in the report.

36. Weather element.—The "weather element" as defined by the Weather Bureau consists of those phenomena occurring in connection with active or imminent precipitation or meteorological disturbances of more or less localized extent and effect. This element includes the occurrence of all rain, snow, sleet, hail, freezing rain, etc., and all thunderstorms, squalls, tornadoes, etc. The weather element immediately follows the visibility in a weather report. It is indicated by various symbols included in appendix I.

37. Obstruction to vision.—*a.* Weather in many cases is an obstruction to vision. In addition there are conditions such as dust, smoke, haze, or any other visibility limiting factor which cannot be classified as weather. The weather element and obstruction to vision are grouped together in a weather report.

b. Examples:

35⊕/—◐6H	Ceiling three thousand five hundred, high overcast, lower thin broken clouds, visibility six, hazy."
60◐4F—	"Scattered clouds at six thousand, visivility four, light fog."
E20◐11/2VR—F—	"Ceiling estimated two thousand, broken clouds, visibility one and one half, variable, light rain, light fog."
00L—FF	"Ceiling zero, visibility zero, light drizzle, dense fog."

38. Sequence of weather and obstruction to vision elements.—The predominating weather element is indicated as the first item followed by other weather elements and obstructions to vision. Example:

T + R F —; R — F —; F — K —; A + F — K —; etc.

39. Barometric pressure.—*a.* Barometric pressure at any level is a measure of the weight of the vertical column of air of unit cross section above that level. For purposes of uniformity and comparison all pressures are reduced to sea level. Accurate data concerning barometric pressure are of high importance to the forecaster in preparation of his weather maps and forecasts. Pressure is reported in millibars and tenths of millibars but is not broadcast unless specifically requested.

b. Sea level pressure.—This is the sum of the station pressure and the pressure of an imaginary column of air between the station and sea level. Tables for the latter have been worked out for various stations.

c. Station pressure.—This is the actual barometric pressure at the station.

d. Method of reporting.—The barometric pressure is indicated by a group of three figures: the first two figures represent the tens and units of millibars, and the last the tenths of a millibar involved. Thus, a pressure of 987.2 millibars would be transmitted as "872," 1001.5 as "015," 1000.00 as "000," etc. The values for barometric pressure are reported immediately preceding the value for temperature.

40. Temperature.—The temperature of the air is of interest and importance in flying operations from the viewpoint of determining the mixture ratios for operations of aircraft engines in taking off and landing, being prepared for slow or fast landings according to whether air immediately over the airport is unusually heated or unusually cold, etc. Also it is extremely important in airway and other forecasting work. Accordingly it is essential that it be reported properly.

41. Dew point.—*a.* The dew point is that temperature to which a given mixed volume of air and vapor must be reduced before saturation occurs. After further reduction of the temperature there results condensation of some of the moisture in the form of dew, fog, frost, clouds, or precipitation. Knowledge of the moisture content of the air is of extreme importance to forecasters, pilots, and others in anticipating the formation of fog, thunderstorms, cloudiness, etc. It is obvious that the dew point in a weather report will never be higher than the temperature.

b. Examples of reports including all elements thus far covered:

PT N E6V⊕2R—F— 987/54/53

(1) "Pittsburgh instrument, ceiling estimated six hundred, variable, overcast, visibility two, light rain, light fog, temperature five four, dew point five three," etc.

CO C —⊕/40⊙5R—F— 013/69/68

(2) "Columbus contact, high thin overcast, lower scattered clouds at four thousand, visibility five, light rain, light fog, temperature six nine, dew point six eight," etc.

LG × 01/8L—FF 999/50/50

(3) "New York closed, ceiling zero, visibility one eighth, light drizzle, dense fog, temperature five zero, dew point five zero," etc.

CV C +14⊕6⊙3F—K— 016/40/36

(4) "Cleveland contact, ceiling more than one thousand four hundred, overcast, lower scattered clouds at six hundred, visibility three, light fog, light smoke, temperature four zero, dew point three six," etc.

42. Wind.—*a. General.*—(1) Wind is the horizontal or nearly horizontal natural movement of air with any degree of velocity.

(2) Vertical movements of air are not considered as wind but as air currents.

b. Direction.—The direction of the wind is reported to 16 points of the compass. In weather reports the wind is reported by means of arrows that fly with the wind. For a chart of arrows and definitions see appendix II.

c. Velocity.—(1) The velocity of the wind is reported in miles per hour. The velocity may be modified by using the minus sign to indicate fresh gusts, the plus sign to indicate strong gusts. These modifying signs follow the velocity in a report. If there is no wind blowing and a calm exists, the letter "C" will take the place of the velocity and will be announced as "Calm."

(2) Occasionally an anemometer fails and it is necessary to estimate the wind velocity. In this case the letter "E" following the velocity will indicate that the wind has been estimated. For a table of wind velocity equivalents see appendix III.

d. Examples:

→↘10	"Wind west north west one zero."
↖9E	"Wind estimated southeast nine."
↓19—	"Wind north one nine, fresh gusts."
↙25+	"Wind northeast two five, strong gusts."
C	"Wind calm."

e. Report including all data up to and including the wind:

KC C 50⊕15⊙4S—K— 000/31/28←↖24—/

"Kansas City contact, ceiling five thousand, overcast, lower scattered clouds at one thousand five hundred, visibility four, light snow, light smoke, temperature three one, dew point two eight, wind east southeast two four, fresh gusts," etc.

43. Wind shift data.—*a.* A wind shift is indicated whenever the wind has suddenly shifted from a southerly or easterly to a westerly or northerly quadrant, accompanied by gusty winds, rapid dew point, and/or temperature drop; in summer, usually lightning and thunder and possibly hail and intense rain; and in winter, snow squalls at frequent intervals and a rapid lowering or lifting of the ceiling. A westerly or northwesterly wind will continue to blow steadily after it has passed, the sky will usually clear rapidly, and the air will feel dryer and cooler, except in a mountainous region. For more detailed information on wind shift data and all weather reporting it is recommended that a copy of "Circular N, Instructions for Airway Meteorological Service," latest edition, be obtained from the Government Printing Office, Washington, D. C.

b. For example of wind shift report see paragraph 46*d*.

44. Altimeter setting.—*a. General.*—The altimeter setting as defined by the Weather Bureau is a pressure, in inches, used for setting a pressure-scale type sensitive altimeter in an airplane so that upon landing of the airplane at an airport the pointers of the instrument will indicate very closely the field elevation above sea level, provided the instrument is functioning properly and is free from error, and that the setting was determined by a properly equipped station near the time and place of landing, and was furnished to the pilot just prior to landing.

b. Methods of reporting.—Weather reports will contain an altimeter setting which may appear as 998. This actually means that the altimeter setting is 29.98 inches. The report "014" is read as "three zero one four" and indicates a pressure of 30.14 inches. Only the last three numbers of the altimeter setting appear on reports. The operator will include the missing portion. If the number is large, two will be added and if the number is small, three will be added: for example, 974 is read, "altimeter, two nine seven four"; 032 is read "altimeter three zero three two."

c. Importance.—(1) The importance of the altimeter setting and its proper reporting cannot be overemphasized. A pilot coming down through an overcast has no means other than the altimeter of knowing how close he is to the ground.

(2) Report including all data up to and including the altimeter setting:

LV × 2+⊕1RF−K− 976/60/60↗19−/954

"Louisville closed, ceiling two hundred, dark overcast, visibility one, moderate rain, light fog, light smoke, temperature six zero, dew point six zero, wind southwest one nine, fresh gusts, altimeter two nine five four."

45. Remarks.—*a.* A space is provided at the end of a weather report for remarks concerning the report itself. It is used to amplify or modify any portion of the weather report which cannot be included in the report proper.

b. Examples of remarks:

+◍ OBSCG MTNS	Dark clouds obscuring mountains.
◍ ALG MTNS	Clouds along mountains.
◍ TPG MTNS	Clouds topping mountains.
E60⊕	Overcast estimated at 6,000 feet. Used when appears in the body of the report and the height of the overcast must therefore be indicated in the remarks.
3◍	Lower scattered clouds at 300 feet. Used when it is necessary to indicate a third layer of clouds.
+⊕NW	Dark clouds northwest.
◍ TURBT	Clouds turbulent.
2F NW	Fog bank to the northwest, visibility 2 miles.
3K NE	Smoky to the northeast, visibility 3 miles.
T APCHG SW	Thunderstorm approaching from the southwest.
RQ W	Rain squall to west.
R+ OCNLY	Rain occasionally heavy.
RE OCNLY	Sleet occasionally mixed with rain.
FK OCNLY	Smoke occasionally mixed with fog.
RANOT	Range facilities inoperative.
FANOT	Fan marker inoperative.
BRONO	Broadcast facilities inoperative.
ZONOT	Zone marker inoperative.

c. The examples in *b* above do not cover every condition but merely illustrate the method used for indicating remarks. For a list of authorized abbreviations used in weather reports and other communications on teletype circuits see appendix VIII.

46. Examples of teletype weather reports.

LS C ⊙/20⊙ 014/30/22→↘14/989

a. The above report will be read as: "St. Louis contact, high scattered, lower scattered clouds at two thousand, temperature three zero, dew point two two, wind westnorthwest one four, altimeter two nine eight nine."

ID C E12⊕◍5SW— 999/28/24→↗6/972/PIREPS +ICE CLDS

b. The above report will be read as: "Indianapolis contact, ceiling estimated one thousand two hundred, overcast, lower broken clouds, visibility five, light snow showers. Temperature two eight, dew point two four, wind westsouthwest six, altimeter two nine seven two. Pilot reports severe ice in clouds."

TH E15⊕◍9SW— 999/30/23→↘14/980

c. The above report will be read as: "Terre Haute, ceiling estimated one thousand five hundred, overcast, lower broken clouds, visibility nine, light snow showers. Temperature three zero, dew point two three, wind westnorthwest one four, altimeter two nine eight zero."

NK × E1⊕3/4R—F— 999/52/52→↘16←0236E/937 CNDS VRBL

d. The above report will be read as: "Newark closed, ceiling estimated one hundred, overcast, visibility three quarters, light rain, light fog. Temperature five two, dew point five two, wind westnorthwest one six, moderate wind shift passed zero two three six, altimeter two nine three seven, conditions variable."

47. Garbled or missing portions.—*a.* Missing or garbled portions of weather or winds aloft reports will be announced as "Missing." Example:

LS C E60—⊕/◍5K— 237/58/60↑16/10P

The above report will be read as: "St. Louis contact, ceiling estimated six thousand, high thin overcast, lower broken clouds, visibility five, light smoke. Temperature five eight, dew point missing, wind south one six, altimeter missing."

b. In copying weather reports or winds aloft reports, receiving operators will copy the letter "M" in place of any portions announced as missing. The copied report above will appear thus:

LS C E60—⊕/◐5K— 58/M ↑ 16/M

c. A sample page of teletype weather reports will be found in appendix V.

SECTION III

WINDS ALOFT REPORTS

48. General.—Observations of upper-air wind directions and velocities are made four times each day at about 100 points in the United States. The times of observation are approximately 5 and 11 AM and PM, eastern standard time, so that all reports throughout the country are made simultaneously. These reports are transmitted over the Civil Aeronautics Administration teletype circuits in regular sequences beginning at 6:04 and 12:04 AM and PM, eastern standard time.

49. Description of code used in reporting.—All winds aloft reports are transmitted by means of a number code wherein the wind data are given by alternate groups of 5 and 4 digits each. The number of groups representing the surface and even 1,000-foot levels consists of 5 digits. The first figure indicates the level. The odd levels consist of 4 digits, the number indicating the level being omitted.

50. Levels for which data are given.—The data are given insofar as they are available, for each 1,000-foot level above sea level up to and including 12,000 feet. Wind directions are given to 36 points, that is, the direction in degrees divided by 10. Velocities are given in miles per hour.

51. Composition of report.—Complete reports consist of the following items:

a. Station designator.—This is the regular CAA two or three letter designation for the station concerned, for example, CV for Cleveland, WA for Washington, etc.

b. Time.—75th meridian time is used for all winds aloft reports. The 24-hour clock is used in reports. Six PM, eastern standard time, would appear as "18."

c. Surface wind data.—This will be the 5 digit group, the first of which will always be zero such as "02216," which would indicate a surface wind direction of 220° and a velocity of 16 miles per hour. The surface wind will not be broadcast. Surface winds change direction more often than upper winds. If a person requests surface wind information, this information will be taken from the most recent surface weather observation.

d. Upper-air data.—The level is indicated by a single figure or omission of the figure: for example, 2 represents 2,000 feet; the next elevation is 3,000 feet and will be indicated by no number; the next is 4,000 feet and is indicated by the figure 4. The direction is indicated by the next two figures as explained in *d* above. The velocity is indicated by the last two figures of each group. For velocities of 100 miles per hour or over, the direction numbers will be increased by 50 and the values above 100 indicated directly by the last two digits. For example, the group "87912" would indicate that at 8,000 feet the direction of the wind is 290°, 112 miles per hour.

52. Indication of calm.—At times there will be certain levels at which a calm exists. This calm is simply indicated by 00 for direction and 00 for velocity. North is indicated by 36 and not 00. Example: 00000 would be read as "Ten thousand, calm."

53. No-observation report.—*a.* In case an observation is not made or not received at the point of transmission prior to the time of filing the report, a no-observation report is filed, consisting of the following items:

(1) *Station designator.*—Same as paragraph 51*b*.

(2) *Time.*—Same as paragraph 51*c*.

(3) *Reason for no observation.*—Use one of the following words:

PICO	Low clouds, none.	PIIO	Instrument trouble, none.
PIRA	Raining, none.	PIBA	No balloons, none.
PISO	Snowing, none.	PIFO	Foggy, none.
PIHE	No helium, none.	PIFI	Not filed.

b. Example of no-observation report:

"CXO5 PICO" would indicate that no observation was made at Cheyenne at 5:00 A. M., eastern standard time, due to low clouds. The information would be broadcast as follows: "No Cheyenne winds aloft report account of low clouds."

54. Missing or garbled portions.—Same as paragraph 47.

55. Examples and phraseology used for communication or broadcasting.—The following are winds aloft reports as they appear on the teletype circuit:

BJ11 02318 2422 22625 2728 42832 2844 62852 2967 83078 3087 03194 8109

a. The above report is broken down into the following separate groups, the exact phraseology to be used for communication or broadcast purposes being inclosed in quotation marks:

BJ11 "Winds aloft report, Buffalo, one one zero zero observation."
02318 (Surface data are not broadcast; see par. 51*d*.)
2422 "One thousand, two four zero degrees, two two."
22625 "Two thousand, two six zero degrees, two five."
2728 "Three thousand, two seven zero degrees, two eight."
42832 "Four thousand, two eight zero degrees, three two."
2844 "Five thousand, two eight zero degrees, four four."
62852 "Six thousand, two eight zero degrees, five two."
2967 "Seven thousand, two nine zero degrees, six seven."
83078 "Eight thousand, three zero zero degrees, seven eight."
3087 "Nine thousand, three zero zero degrees, eight seven."
03194 "Ten thousand, three one zero degrees, nine four."
8109 "Eleven thousand, three one zero degrees, one zero nine."

CX18 01608 1714 81816 1820 02022 2120 22417 2525

b. The above report is broken down as follows:

CX18 "Winds aloft report, Cheyenne, one eight zero zero observation."
01608 (Surface data, do not broadcast.)
1714 "Seven thousand, one seven zero degrees, one four."
81816 "Eight thousand, one eight zero degrees, one six."
1820 "Nine thousand, one eight zero degrees, two zero."
02022 "Ten thousand, two zero zero degrees, two two."
2120 "Eleven thousand, two one zero degrees, two zero."
22417 "Twelve thousand, two four zero degrees, one seven."
2525 "One three thousand, two five zero degrees, two five."

c. Figures above 12,000 feet will be announced by calling the first 2 digits and adding the word "thousand." The last elevation in the above report is an example. Further examples:

26000 "Two six thousand."
17000 "One seven thousand."
43000 "Four three thousand."

SECTION IV

RADIO CALL SIGNS

56. Ground stations.—Radiotelephone call signs for ground stations will be designated by specific geographical names, plus the name designating the type of communication service being called.

57. Airplanes.—*a.* Airplane call signs are composed of not less than four numbers. As far as the radio operator is concerned, the method of deriving the numbers is not important. Each ship will have its call sign painted or printed in the vicinity of the radio station. A good many Army aircraft have the number painted across the microphone, leaving very little chance of confusion of call letters when operators change from ship to ship. In calling any radio stations other than Army stations, the word "Army" will precede the ship's call letters. When calling Army stations, it is not necessary to include the word "Army."

b. Control towers will be designated by the name of the field at which they are located, plus the word "tower."

Example: "Scott tower," "Chanute tower," etc.

c. Army airways stations (AACS) will be designated by the name of the field at which they are located, plus the words "Army airways."

Example: "Scott Army airways," "Chanute Army airways," etc.

d. Radio ranges will be designated by the name of the field at which they are located, plus the word "radio."

Example: "Scott radio," "Chanute radio," "St. Louis radio," etc.

e. Example of Scott Field's training ship calling the range station at St. Louis: "St. Louis radio from Army eight five zero six, go ahead."

f. Example of Scott Field Army airways control station calling the same ship: "Eight five zero six from Scott Army airways, go ahead."

SECTION V

CONTROL TOWERS

58. General.—It is the primary responsibility of the control tower operator to observe traffic conditions around the immediate vicinity of the airport and keep pilots advised of these conditions. However,

the presence of a control tower in no way relieves the pilot of an airplane of the responsibility of exercising every precaution within his power to avoid hazardous situations. In some localities it is necessary to clear local tactical or training flights by agencies other than control towers.

59. Take-off instructions.—*a.* Departing aircraft will contact the control tower for take-off instructions prior to taxiing away from the line or parking area and will not depart until advised to do so. Traffic control tower operators at Army Air Force stations will include the following information in take-off instructions in the sequence given:

(1) Wind direction and velocity.
(2) Runway and field conditions.
(3) Special instructions concerning local conditions.
(4) Taxi clearance.
(5) Take-off clearance.
(6) Altitude of field and correct time—given only upon request of pilot.

b. Example of take-off instructions:

Ship: "Scott tower from eight five zero six, go ahead."
Tower: "Eight five zero six from Scott tower, go ahead."
Ship: "Taxi clearance, go ahead."
Tower: "Wind east twelve E one two. Field is soft, use east-west runway. Heavy construction in progress southeast of field. Taxi to west end of east-west runway, go ahead."
Ship: "Wilco."
Ship: After taxiing to take-off position. "Scott tower from eight five zero six, take-off clearance, go ahead."
Tower: "Eight five zero six, cleared for take-off, go ahead."
Ship: "Wilco."

60. Guarding tower frequency after take-off.—Upon departure, airplanes will remain tuned to the tower frequency for at least 5 minutes after departure unless cleared to another frequency by the control tower.

61. Landing instructions.—*a.* An airplane approaching an Army Air Force field will contact the traffic control tower when approximately 10 minutes from the field. The pilot will give his position and stand by for landing instructions. When about 1 minute from the field, the pilot will again call the tower advising him of his position. The tower will then furnish landing instructions in the following sequence:

(1) Wind direction and velocity.
(2) Traffic information concerning other ships in vicinity.

(3) Field conditions including runway or area to be used in landing.
(4) Landing sequency.
(5) Altimeter setting—given only on specific request of pilot.

b. Example of landing instructions:

Ship: "Chanute tower from eight five zero six, go ahead."
Tower: "Eight five zero six from Chanute tower, go ahead."
Ship: "Fifteen miles north of Tuscola at two thousand feet, contact, landing at Chanute field, go ahead."
Tower: "Roger."
The ship is now about 1 minute from the landing field.
Ship: "Chanute tower from eight five zero six, landing instructions, go ahead."
Tower: "Eight five zero six from Chanute tower, wind southwest fifteen SW. one five. P–40 now approaching field to land. Field is soft, use the northeast-southwest runway, you are second to land, go ahead."
Ship: "Roger."
The P–40 is now on the ground and has cleared the runway.
Tower: "Eight five zero six from Chanute tower, you are cleared to land, go ahead."
Ship: "Wilco."

62. Sighted aircraft in vicinity of field.—*a.* Control tower operators will initiate calls to aircraft sighted approaching the field or seen taxiing out on the field that have not previously called for instructions. The type of ship and its location may be used as its call sign for this purpose. Example:

Tower: "C39 about 4 miles south of the field from Chanute tower, go ahead." The ship does not answer. It is assumed that his transmitter is inoperative. The tower will call again thus:
Tower: "C39 about 4 miles south of the field from Chanute tower, if you are receiving me rock your wings, go ahead."

b. If the ship is equipped with a receiver that is in operation, the pilot will acknowledge by rocking the ship's wings. The tower will then stand by. If the ship begins circling the field, the tower operator will issue landing instructions by radio, the pilot acknowledging by some visual signal as rocking wings. If the ship does not rock its wings upon request of the tower, the tower operator will assume that the ship has no radio facilities. If the ship begins circling the field, the tower operator will understand this as being a signal that the ship

desires to land. He will then issue landing instructions by using the light gun. A table of standard light signals for control tower operation will be found in appendix VII.

SECTION VI

CIVIL AIR REGULATIONS

63. General.—An Army Air Force operator's value to the service will be enhanced a great deal if he has a fair knowledge of civil air regulations as pertain to air traffic rules.

64. Contact flight.—Contact flight is flight of aircraft in which the attitude of the aircraft and its flight path can at all times be controlled by means of visual reference to the ground or water.

65. Instrument flight.—Instrument flight is flight of aircraft in which visual reference is not continuously available, and the attitude of the aircraft and its flight path can be controlled in part or in whole by reference to instruments only.

66. Airport control tower.—An airport control tower is an establishment properly situated and equipped to allow an operator thereof adequately to control air traffic in the immediate vicinity of the airport on or adjacent to which such airport control tower is located.

67. Civil Airway.—A civil airway is a route in the navigable air space designated by the Secretary of Commerce. It includes the area 10 miles to either side of the center of such airway.

68. Control zone.—A control zone is the air space above an area within a circle with a radius of 3 miles drawn from the center of a control airport, provided, however, that if a radio directional aid station designed to direct air traffic to the control airport is more than 3 miles from the center thereof, then the control zone is extended above an area ½ mile on each side of a line projected from the center of such airport to such radio aid.

69. Control zone of intersection.—A control zone of intersection is the air space above an area within a circle with a radius of 25 miles drawn from the center of the zone of intersection.

70. Center of control zone of intersection.—The center of a control zone of intersection is—

a. The radio range station located at an intersection of airways; or

b. The center of the intersection of the on-course radio range signals projected down intersecting airways; or

c. The center of an on-course signal projected down an airway at a point designated by the Secretary of Commerce.

71. Flight plan.—See paragraphs 93 and 94.

72. Alternate airport.—An alternate airport is an airport, other than the point of first intended landing, specified in the flight plan, and to which the flight may be directed in case of emergency.

73. Radio fix.—A radio fix is a geographical location on a civil airway, above which the position of an aircraft in flight can be accurately determined by means of radio only. Radio fixes may be determined by means of a cone of silence marker (Z marker), fan type marker, or intersection of range on course signals.

74. Check point.—A check point is a geographical location on the surface of the land or water above which the position of an aircraft in flight may be determined by means of visual reference.

75. Airway traffic control area.—An airway traffic control area is an area within the limits of designated civil airways over which a particular airway traffic control station exercises traffic control.

76. Airway traffic control station.—An airway traffic control station is a station operated by the Civil Aeronautics Administration for the purpose of air traffic control on civil airways within the jurisdiction of such station.

SECTION VII

RADIO RANGE STATIONS

77. General.—Ground-to-plane and plane-to-ground communication has proved to be an absolute necessity if operation of aircraft is to be maintained with reliability and safety. Information relative to weather conditions along an airway is of vital importance to the pilot who is either flying blind, or over the top, or is about to take off for

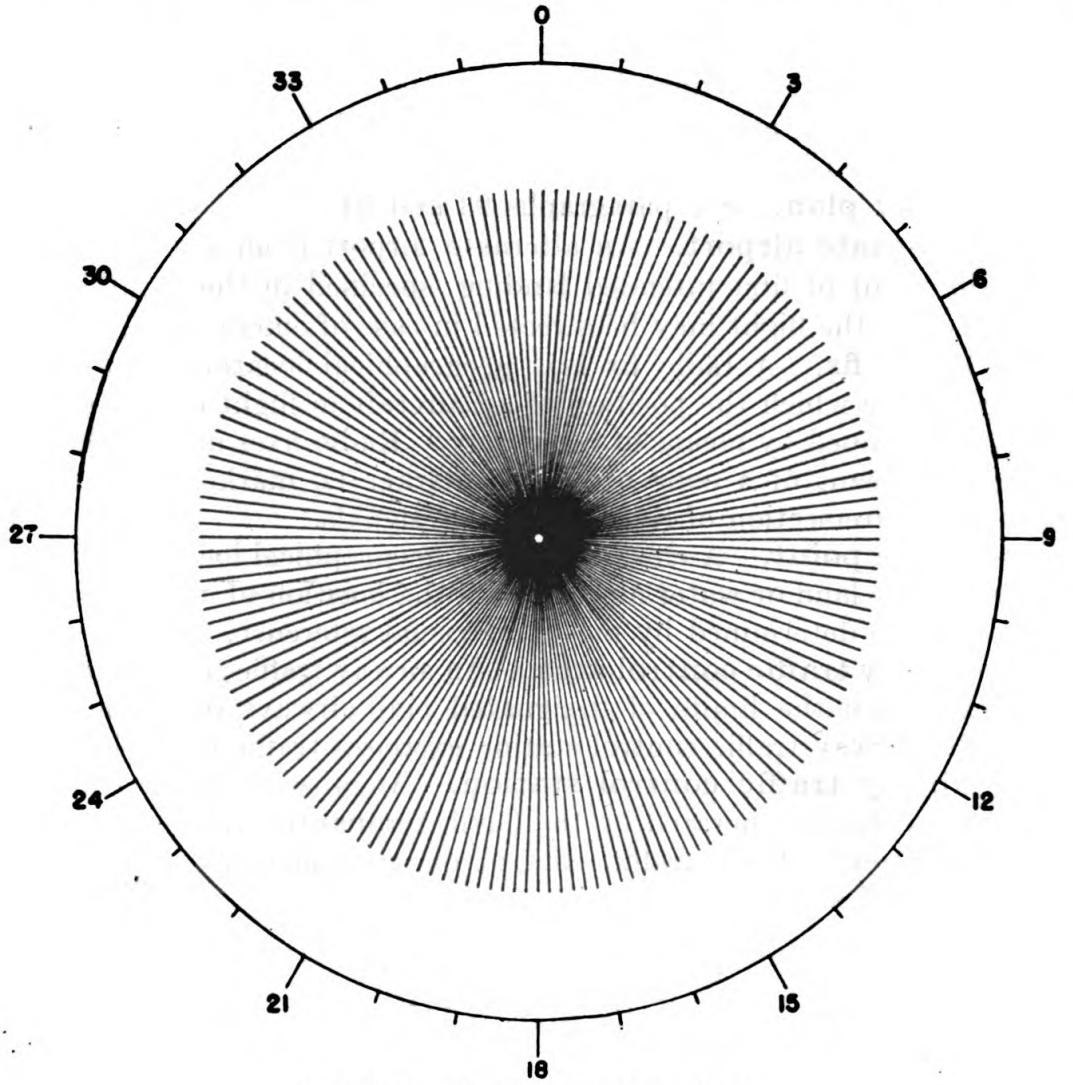


FIGURE 2.—Omnidirectional broadcast antenna.

some particular destination. To meet this requirement, the Civil Aeronautics Administration has installed and maintains radio range stations throughout the United States. These stations are located on all the airways and are the guides and markers for the aerial highways. It would be possible for a pilot to depart from Boston and fly to Seattle without ever seeing the ground, his only means of determining his position being by radio range stations.

78. Types of ranges.—There are several types of radio ranges. They all have the same task to perform—to produce a beam on which

the pilot may depend to guide him safely to his destination. The type of range to be discussed in this section is the simultaneous radio range and voice transmitter using vertical radiators (Adcock system). Other types of ranges using loop antennas and tone modulated signals are being replaced by the more modern equipment.

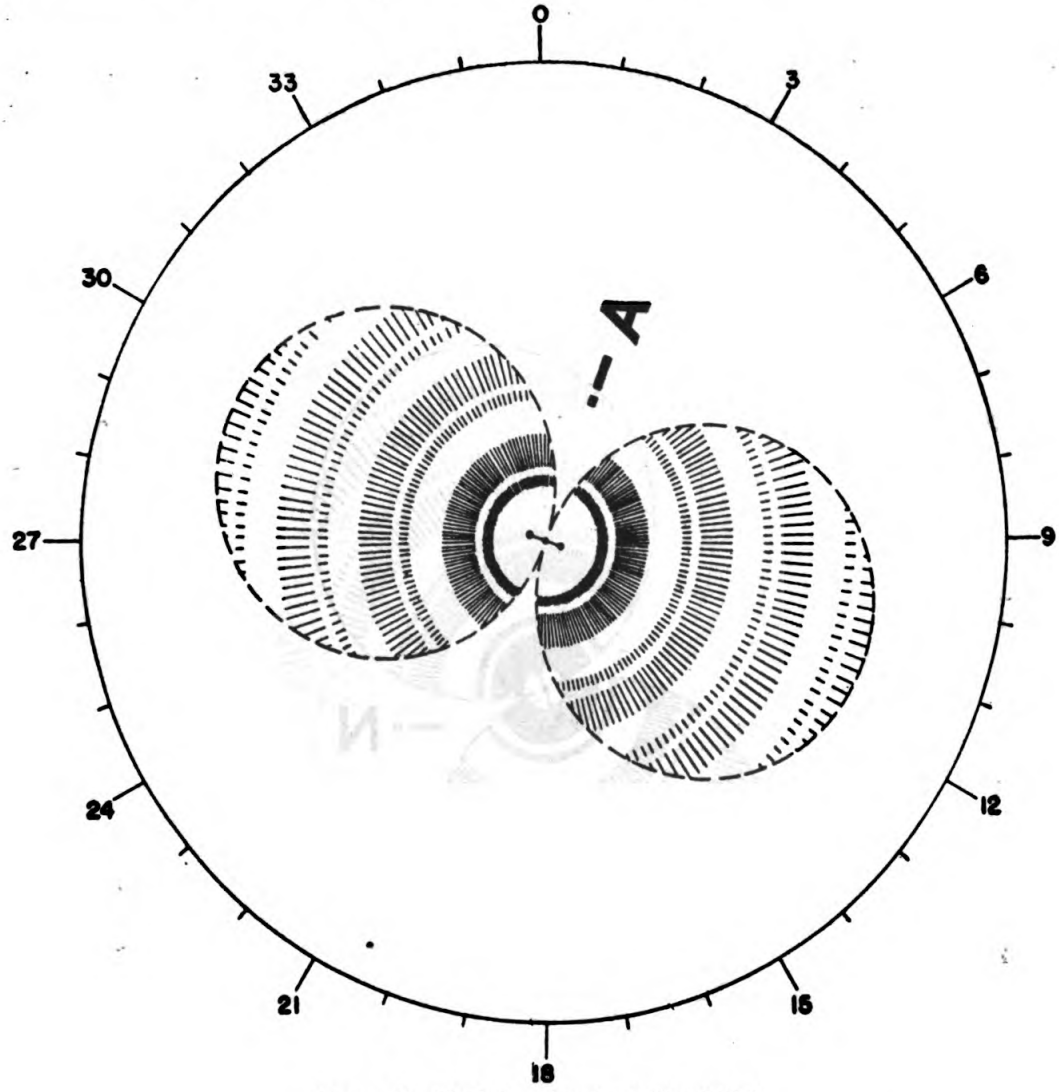
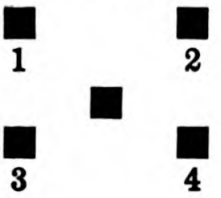


FIGURE 3.—Single loop bearing 110° and 290°.

79. Simultaneous range and voice transmitter.—The simultaneous range and voice transmitter consists of two complete transmitters operating on separate frequencies. The voice or carrier frequency is the assigned frequency of the station. The range or side-band frequency is 1,020 cycles higher than the assigned frequency. When both transmitters are on together, an audible heterodyne or beat frequency of 1,020 cycles is produced.

80. How an on-course signal is produced.



In the above illustration the squares represent vertical antennas or towers looking down from above. The center tower emits a continu-

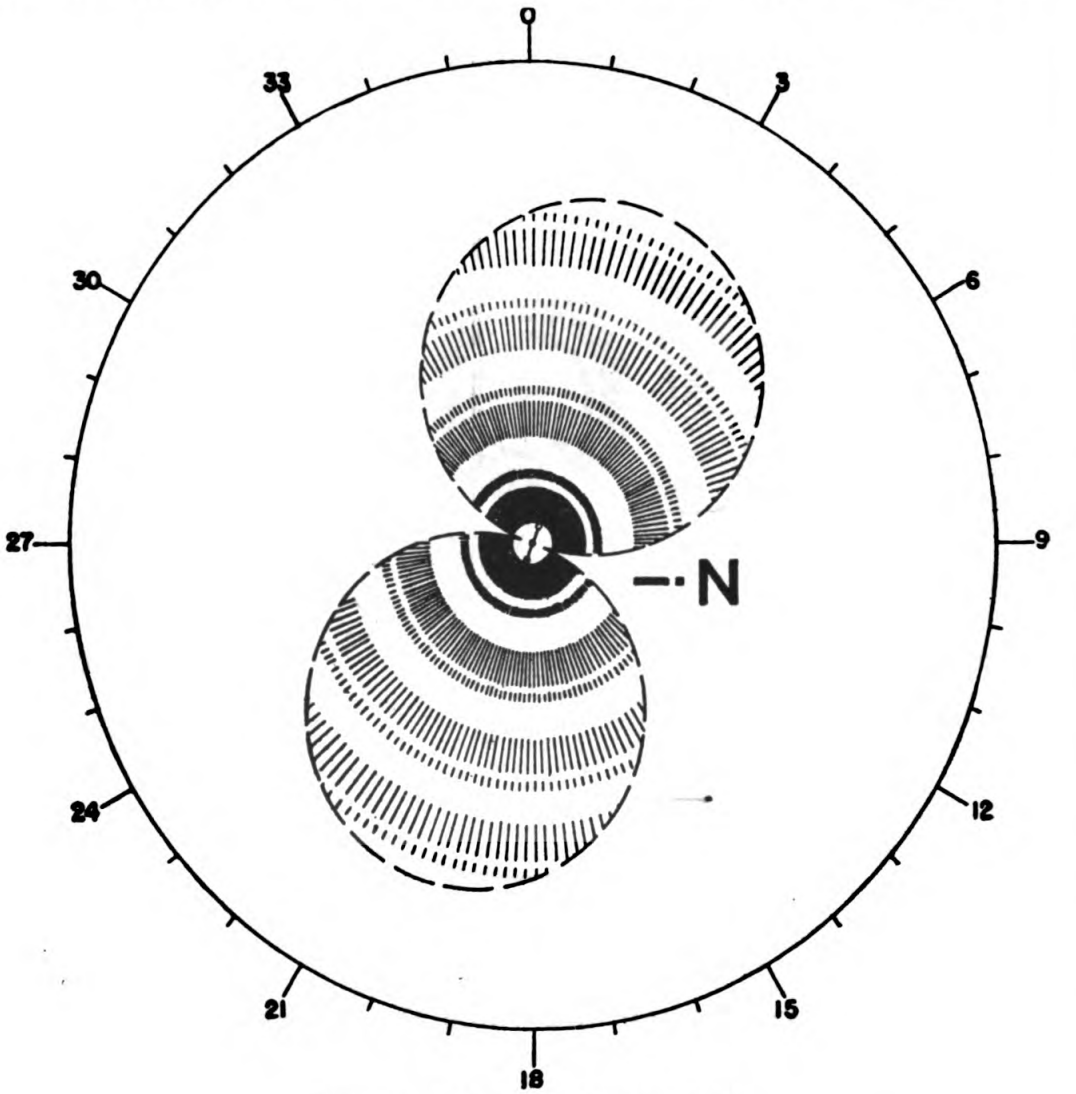


FIGURE 4.—Single loop bearing 20° and 200°.

ous uninterrupted wave on the assigned frequency (fig. 2). Towers 1 and 4 are connected together at the transmitter. Towers 2 and 3 are connected together at the transmitter. The range signal radio frequency power is fed to the opposite pair of towers. The radio frequency field pattern radiated from the two sets of towers takes the

form of two crossed figures of eight (fig. 5). A motor-driven keying device keys the letter "N" into one pair of towers (fig. 4) and the letter "A" into the other pair of towers (fig. 3). These signals are interlocked so that when received at a point along the line of equal field intensities from both pairs of towers, the N and A signals merge to form a long dash (fig. 6). This constitutes an on-course signal and

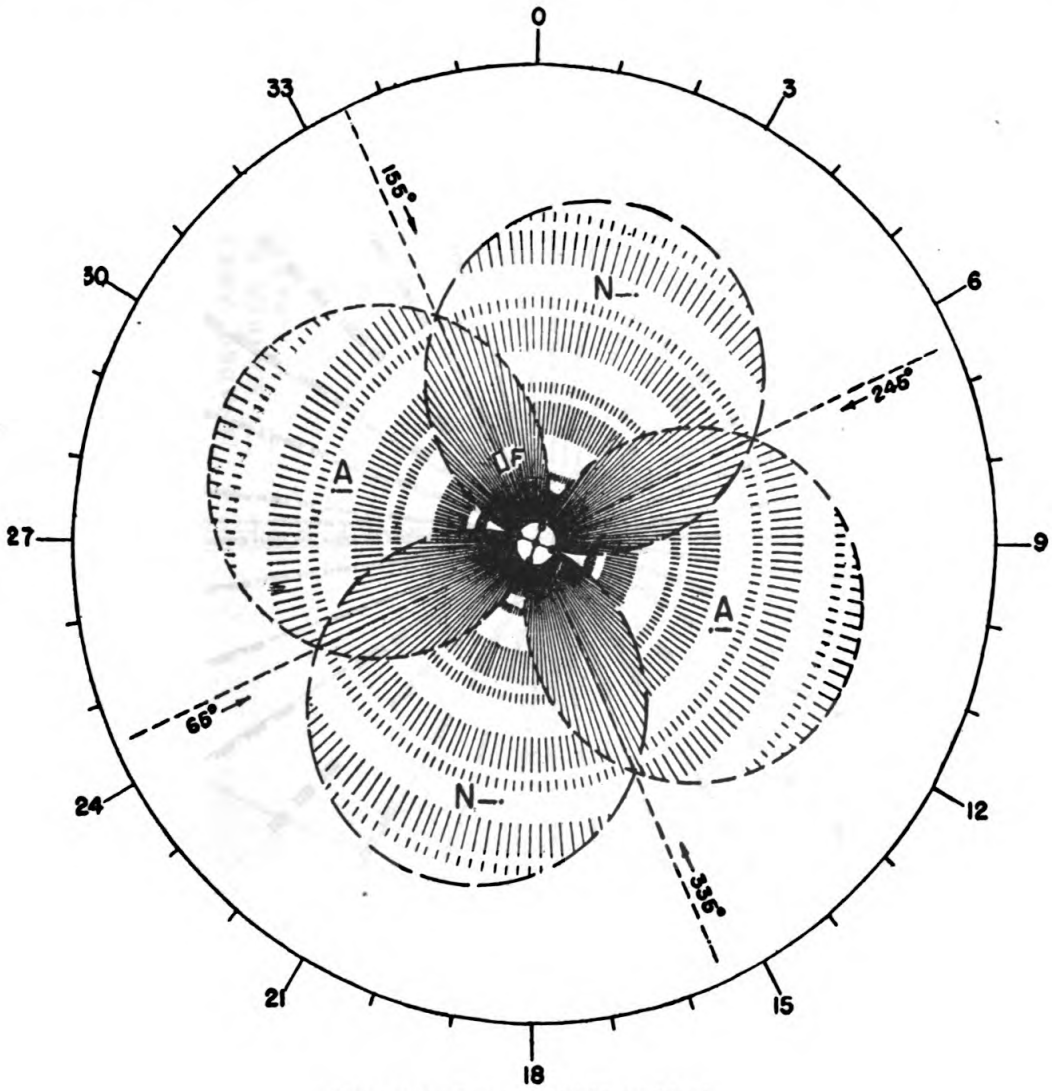


FIGURE 5.—Loops A and N combined.

is about 3° in width. Off course to one side or the other, either the N or the A signals predominate, since the field intensities from the two sets of towers are not equal. Thus the system gives four courses, the spaces between the courses being termed "quadrants." The interlocked signals are transmitted for approximately 29 seconds, followed by the station identifying signal which is keyed into first one pair of towers and then the other pair. The N and A signals are transmitted

such that true north line always passes through an N quadrant except when a course lies due north, in which case the N lies in the northwest and southeast quadrants.

81. Nonscheduled or emergency broadcasts.—Nonscheduled or emergency broadcasts on radio ranges are preceded by an attention

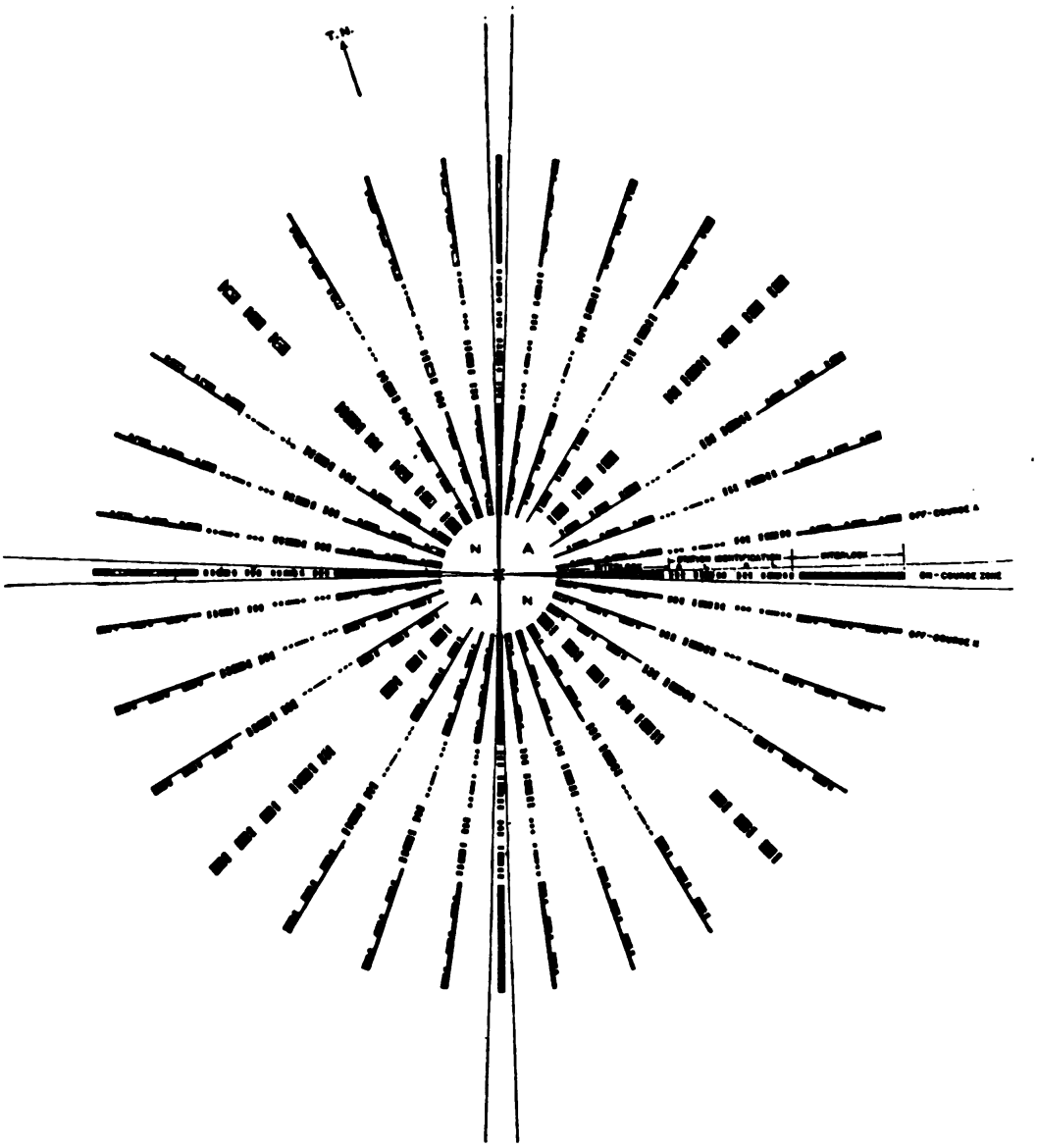


FIGURE 6.

signal consisting of a series of dots (about 10 or 12) which are transmitted for approximately 1 second. This is a warning to pilots using range filter to switch over and listen to voice.

82. Frequency allocation.—Radio ranges are allocated to the frequeney band of 200 to 400 kilocycles.

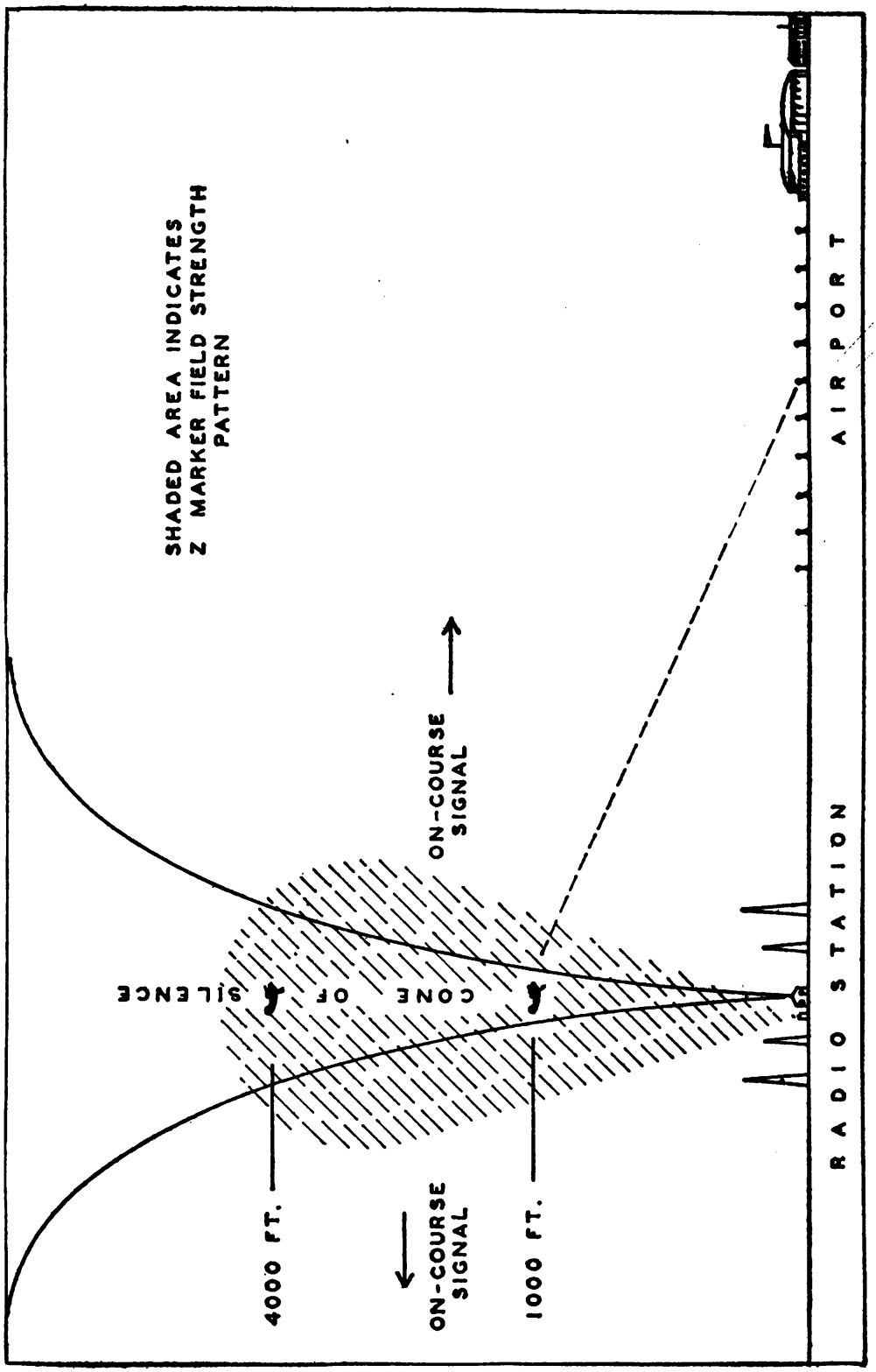


FIGURE 7.

83. Multiple courses.—Multiple or split courses are false on-course indications which occur in the transmission of most radio ranges located in mountainous territory. These multiple courses manifest themselves as on-course signals at points where either the

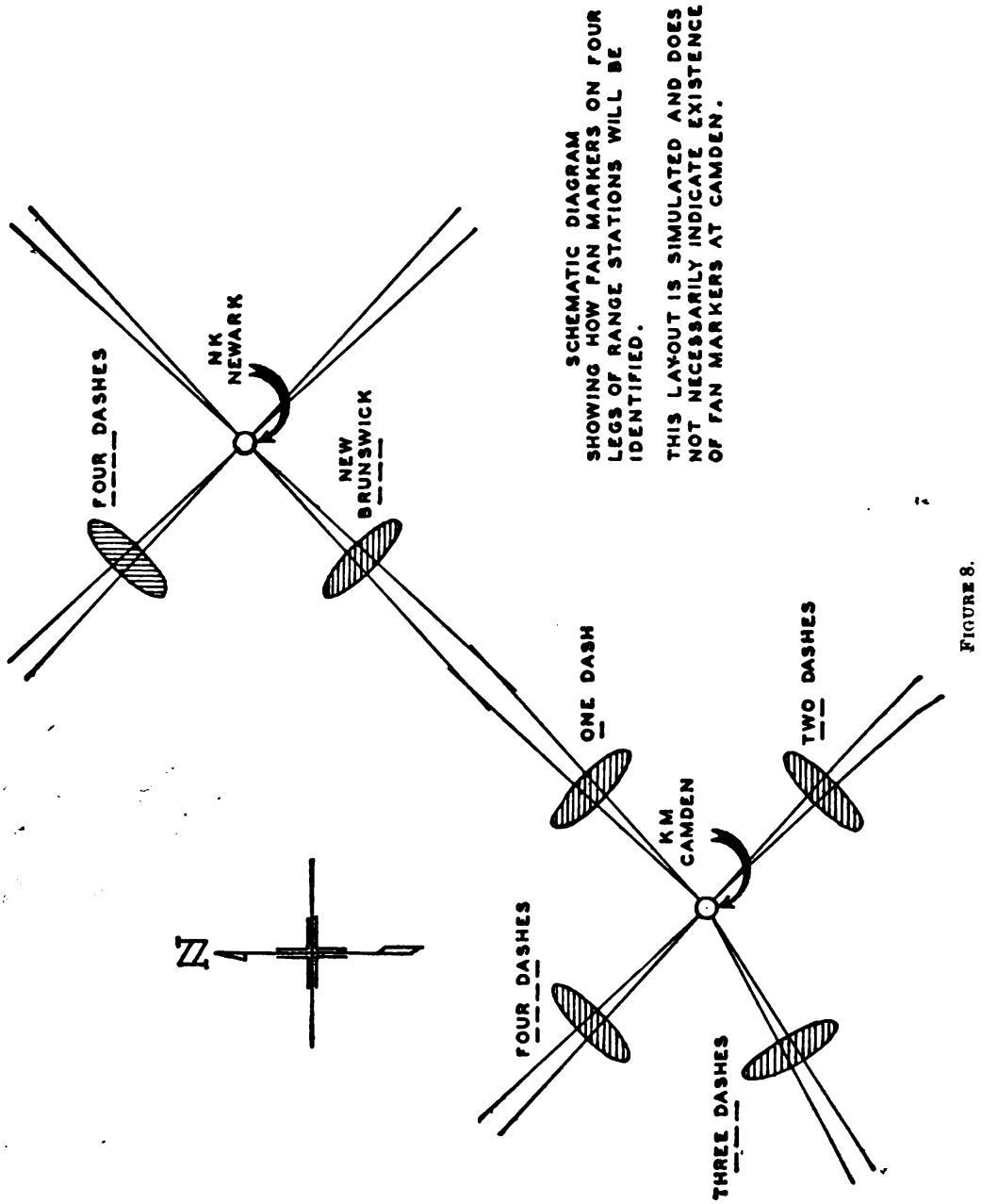


FIGURE 8.

A or the N signals should predominate and may be misconstrued by the pilot as the true on-course signal. They usually exist within plus or minus 5° of the true courses. At stations where multiple courses exist, airmen are warned in notices of their existence and they then use the range station accordingly.

84. Cone of silence marker.—A characteristic of a radio range is the cone of silence (fig. 7), a zone of zero field intensity directly above the range station caused by cancelation of the radiated field at this point. It is very useful to the pilot in determining when he has passed the radio range station. The zone of zero field intensity is proportional to the altitude, taking the form of an inverted cone. This cone of silence is so useful to pilots as an aid in orienting their position preparatory to landing that a definite and wider marker was necessary. Thus the cone of silence marker came into being. This consists of an ultrahigh frequency transmitter (75 megacycles) located near the center tower of a range station. The antenna is arranged so that the field strength pattern of the radiated signal is cone-shaped, the apex of the cone resting on the antenna. This signal is modulated with a 3,000-cycle note and is continuous. The radiated signal fills the void over the range station and definitely indicates to the pilot his exact position. To receive this signal it is of course necessary that the aircraft be equipped with a 75-megacycle receiver, also known as a marker beacon receptor.

85. Z marker.—See paragraph 84.

86. Station location marker.—See paragraph 84.

87. Fan marker.—A fan marker is a 75-megacycle transmitter which radiates upward a fan-shaped field strength pattern which is ordinarily placed at right angles to one of the legs of a range station. (See fig. 8.) These markers are located at definite known distances from the range station. Each marker transmits a series of dashes which identify the particular marker. The marker serves to provide the pilot with a definite fix. The identification for the various markers is such that the true north leg will be identified with one dash, or if the leg is not true north then the next leg clockwise from true north will be identified with one dash, the next leg clockwise will be identified by two dashes, etc. The transmissions are modulated with a 3,000-cycle note. Army aircraft equipped with marker beacon receptors give a visual indication by the lighting of an amber light on the instrument panel. The amber lamp will flash the number of dashes to identify the marker.

88. False cone of silence.—Frequent reference is made to so-called false or fake cones of silence. These false cones of silence are simply fades. Fading might occur anywhere, but it is generally confined to hilly or mountainous terrain and moderately low altitudes above the ground. Occasionally fading has been noted when flying at low altitude over high voltage transmission lines. The degree of change in signal strength is not always constant, some fades being

barely perceptible. A 10 to 1 drop in signal strength is unusual except in rugged mountainous terrain. In the Rocky Mountains abrupt changes in signal level of as much as 100 to 1 are sometimes encountered. The fades are usually of short duration. These fades have caused confusion with the true cone of silence. Ships flying toward a station equipped with a Z marker may easily disregard any fades because the true cone of silence will be indicated by reception of the Z marker signal.

89. Radio range and flight radio operator.—A radio operator in flight will have occasion to communicate frequently with radio range stations. The operator's transmissions will be made on the liaison transmitter. For receiving the range stations it will be necessary to use the compass receiver because the liaison receivers do not cover the frequency band to which radio range stations are assigned. Communication with range stations is at the pilot's discretion. The pilot may wish to contact the stations himself. On the other hand if the pilot desires, he will turn the compass receiver over to the radio operator and advise him to contact the range stations. The radio operator's duties will then be to transmit to the range station the ship's position report, receive weather reports at stations over which passing, and receive traffic and other information. The procedure for communicating with radio range stations is prescribed in section VIII. Contacts will be businesslike and concise. The CAA personnel judge the Army Air Force by the method in which communication contacts are handled by Army Air Force personnel.

SECTION VIII

PROCEDURE FOR COMMUNICATING WITH CAA RANGE STATIONS

90. General.—Pilots or radio operators will contact CAA radio range stations for the purpose of reporting their position, requesting weather and traffic information, filing flight plans, or making changes in flight plans.

91. Position report.—*a.* Position reports will be made to range stations in the following sequence:

(1) Ship's call.
(2) Name of pilot (last name only, grade is omitted).
(3) Position.
(4) Time over reported position.
(5) Altitude.
(6) Flight conditions (contact, instrument, on top, between layers, etc.).

b. Example of position report:

Ship: "Denver radio from army eight five zero six, go ahead."
Denver: "Army eight five zero six from Denver radio, Go ahead."
Ship: "Army eight five zero six, pilot Wilson, two five east of Denver, one two five zero central standard, at eight thousand, on instruments. Estimating Denver at one three zero zero central standard, go ahead."
Denver: "Army eight five zero six, Denver, pilot Wilson, I will repeat your position, two five east of Denver, one two five zero central standard, at eight thousand, on instruments. Estimating Denver at one three zero zero central standard, go ahead."
Ship: "That is correct, go ahead."
Denver: "Roger."

c. Note that the position report was repeated to the ship. This will always be done. It serves a double purpose. First, it verifies the position report as transmitted by the ship. If any discrepancies are found, they will be immediately corrected by the ship's operator. Second, it serves as a broadcast to all other ships that may be in the vicinity of the particular range station, notifying all ships on the range frequency of the position of the ship just reported.

92. Use of tone telegraphy in contacting CAA stations.— *a.* When unable to contact CAA stations or AAC stations by voice transmission, an attempt should be made using tone telegraphy. Radio range identification letters may be used for calling stations when reply is desired on the range frequency. When reply is desired on 4,220 kc from an AAC station, the call letters listed for these stations in the facility charts should be used. (See sec. XI.) Under ordinary circumstances communication once established may then be continued by means of voice. Complete messages should not be transmitted by tone telegraph except under unusual circumstances when voice transmission is unintelligible.

b. Tone modulated telegraphy is stressed because continuous wave telegraphy will not be heard. Ground stations maintain a watch

without the use of the beat frequency oscillator, making the use of tone telegraphy mandatory.

93. Contact flight plan.—*a.* A flight plan is not required by civil air regulations for contact flight at any altitude outside of the boundaries of civil airways, though one may be submitted if desired. Likewise, a flight plan is not required for contact flight on or across civil airways at altitudes of 3,500 feet or less above the ground or water. However, within the limits of a civil airway, a contact flight made above 3,500 feet above the ground or water (not above sea level) requires the observance of instrument flight rules in the following respects:

(1) An approved flight plan before take-off from within or before entering an airway traffic control area.

(2) Maintenance of flight altitudes.

(3) Maintenance of communication contacts, therefore requiring that aircraft be equipped with two-way radio.

b. Position reports may be made, even though a flight plan has not been filed. The CAA radio operator will ask if a flight plan has been filed. If one has been filed, the CAA operator will forward the ship's progress report. If a flight plan has not been filed, the CAA operator will record the communication contact and take no further action.

94. Instrument flight plan.—*a.* A flight plan is not required by civil air regulations for instrument flight made entirely off airways and not entering control zones of intersection. Instrument flight made partially off airways does not require the filing of flight plan with the Civil Aeronautics Administration, provided all portions of the flight made within the airways and within control zones of intersection are made under contact weather conditions and under contact flight rules at or below 3,500 feet above the ground or water. However, when class N (instrument) or class X weather conditions prevail within the civil airways over that portion or portions within which flight is to be made, the following rules will govern:

(1) Prior to take-off from any point within an airway traffic control area and prior to entering such an area, an approved flight plan is required as prescribed in CAR 60.134.

(2) On civil airways not within an airway traffic control area, and where no approved flight plan has been obtained, no control zone of intersection, served by CAA radio voice communication station, will be entered without first establishing communication with such station, directly or through channels and forwarding essential information of the flight plan as described below:

Sequence	*Example*
Ship's call	8506
Type of ship	Army C-39
Pilot's name	Allee
Point of departure	Scott Field
Altitude	4,000 (give appropriate altitude)
Destination	Scott Field
Route	Via (give route)
Air speed	180
Transmitting frequency	4495
Time of departure	1042CS
Estimated elapsed time	3 hours 10 minutes
Alternate airport	St. Louis (give appropriate airport)
Remarks	Circle flight

b. The flight plan (*a*(2) above), often referred to as a PX, will appear on a teletype circuit, thus:

8506 ARMY C39 ALLEE 4CD 40 CD VIA LS CA KC 50 CA LS 30 CD 180 4495 D1042CS 3+10 LS CIRCLE FLIGHT

NOTE.—A contact flight plan is similar to an instrument flight plan except specific altitudes are not mentioned. In place of altitude the abbreviation CFR (contact flight rules) is used. An alternate airport is not included.

95. Communication contacts.—*a.* On an instrument flight, a continuous listening watch will be maintained on the appropriate radio frequency. The pilot or radio operator will contact and report as soon as possible to the appropriate communication station the time and altitude of passing each radio fix or other check point designated by the Secretary of Commerce or specified in the flight plan, together with unanticipated weather conditions being encountered and any other information pertinent to the aircraft movement. If not within an airway traffic control area, the pilot or radio operator will, prior to entering a control zone of intersection served by a CAA radio voice communication station, establish communication with such station, directly or through other communication channels, forwarding the expected time of arrival over the center of such zone, the altitude to be flown through such zone, and the course or courses proposed to be followed while within such zone.

b. Example of contact with control zone of intersection:

Ship: "Columbus radio from Army eight five zero six, go ahead."
Columbus: "Army eight five zero six from Columbus radio, go ahead."

Ship: "Army eight five zero six, pilot Case, over the Brighton fan marker, one four one five eastern standard, at three thousand, on instruments. Estimating Columbus one four two five eastern standard, at three thousand. After passing Columbus will continue on east leg of Columbus range to Cambridge, go ahead."

Columbus: "(Here Columbus repeats the entire text of the position report.)"

Ship: "That is correct, go ahead."

Columbus: "Roger."

96. Summary of communication duties.—*a.* Whether a radio operator will or will not contact communication stations is at the discretion of the pilot. If the pilot assigns communication duties to the radio operator, he must be prepared for the task and must know what to do. Common sense in most cases will solve the difficulties.

b. Requests for weather information will be made after the ground station has the position report.

c. The receipt of a traffic clearance into a control zone is normally the pilot's duty. The radio operator may be called on, however, to copy verbatim the clearance to be given to the pilot. The first rule of communication must be remembered: *Never acknowledge or receipt for anything unless the message has been received and there is no doubt about its accuracy.* A traffic control clearance contains vital information. The radio operator's life may depend on the accuracy with which this information is received.

d. Ability to copy accurately all weather reports cannot be overemphasized. The information received will guide the pilot in making his flight under instrument conditions.

Section IX

EMERGENCY PROCEDURE

97. Establishing contact.—Normally, calls to aircraft will be restricted to two attempts to establish contact with an interval of 15 seconds between calls. If contact is not established, a third call will be made, after an additional 15-second interval, the communication

then being transmitted as a blind broadcast and terminated by a request for receipt. If no receipt or acknowledgment is received, the three calls, followed by the blind broadcast, will be repeated at intervals of not less than 3 nor more than 5 minutes until the emergency communication has been transmitted three times.

98. Scheduled contacts.—When an aeronautical ground station does not receive an answer from an aircraft station at time of scheduled contact, it will repeat the call at 15-second intervals during time allotted to contact (1 minute). If the operator is unable to establish contact with the aircraft station, he will make use of all available facilities, including CAA stations, to get information to pilot or to reestablish contact.

99. Distress signals.—Listed below are extracts from the general radio regulations pertaining to safety of aircraft:

a. In radiotelegraphy, the distress signal shall consist of the group . . . — — — . . . transmitted as one signal, in which the dashes must be emphasized so as to be distinguished clearly from the dots. This signal is often referred to as SOS. Actually SOS is meaningless. VTB, 3B, STMS, or any other combination would produce the same signal, but inasmuch as it has been customary to refer to the distress signal as SOS no attempt is being made to eliminate it. It should be borne in mind, however, that the signal is sent as one character. If it is to be recorded it may be written as SOS.

b. In radiotelephony, the distress signal shall consist of the spoken expression MAYDAY.

c. These distress signals shall announce that the ship, aircraft, or any other vehicle which sends the distress signal is threatened by serious and imminent danger and requests immediate assistance.

d. This call shall have absolute priority over other transmissions. All stations hearing it must immediately cease all transmissions capable of interfering with the distress traffic, and must listen on the frequency used for the distress call.

e. The distress call must be followed as soon as possible by the distress message. This message shall include the distress call followed by the name of the ship, aircraft, or other vehicle in distress, information regarding the position of the latter, the nature of the distress and the nature of the help requested, and any other further information which might facilitate this assistance.

f. When, in its distress message, an aircraft is unable to signal its position, it shall endeavor after the transmission of the incomplete message to send its call signal long enough so that the radio direction-finding stations may determine its position.

g. As a general rule, a ship or aircraft at sea shall signal its position in latitude and longitude (Greenwich) using figures, for the degrees and minutes, accompanied by one of the words North or South and one of the words East or West. A period shall separate the degrees from the minutes. In some cases, the true bearings and the distance in nautical miles from some known geographical point may be given.

h. As a general rule, an aircraft flying over land shall signal its position by the name of the nearest locality, its approximate distance from this point, accompanied, according to the case, by one of the words North, South, East or West, or, in some cases, words indicating intermediate directions.

i. The distress call and message shall be sent only by *order of the master or person responsible* for the ship, aircraft, or other vehicle carrying the mobile station.

j. Stations of the mobile service which receive a distress message from a mobile station which is unquestionably in their vicinity must acknowledge receipt thereof at once.

k. Stations of the mobile service which receive a distress message from a mobile station which unquestionably is not in their vicinity must wait a short period of time before acknowledging receipt thereof, in order to make it possible for stations nearer to the mobile station in distress to answer and acknowledge receipt without interference.

100. Urgent signals.—*a.* In radiotelephony the urgent signal will consist of three transmissions of the expression PAN; it will be transmitted before the call.

b. The urgent signal will indicate that the calling aircraft station has a very urgent message to transmit concerning its own safety or concerning the safety of another aircraft or ship.

c. In the aeronautical service, the urgent signal PAN will be used in radiotelegraphy and in radiotelephony to indicate that the aircraft transmitting it is in trouble and is forced to land, but that it is not in need of immediate help. This signal should, so far as possible, be followed by a message giving additional information.

d. The urgent signal will have priority over all other communications, except distress communication, and all mobile or land stations hearing it must take care not to interfere with the transmission of the message which follows the urgent signal.

e. The urgent signal may be transmitted only with the authorization of the master or of the person responsible for the aircraft.

101. Transmitter adjustment for distress.—The transmitting set in a radio station may be adjusted in such a manner as to produce a maximum of radiation, irrespective of the amount of inter-

ference which may thus be caused, when such station is sending radio communications or signals of distress and radio communications relating thereto.

102. Fraudulent signals of distress.—Section 325 of the Communication Act of 1934, paragraph A, states: "No person within the jurisdiction of the United States shall knowingly utter or transmit, or cause to be uttered or transmitted, any false or fraudulent signal of distress, or communication relating thereto."

103. Penalties.—Unlawful acts pertaining to radio communication are punishable by a fine of not more than $10,000 or by imprisonment for a term of not more than two years, or both, as provided by section 501 of the Communication Act of 1934.

SECTION X

FREQUENCIES

104. General.—The frequencies given in paragraphs 105 to 112, inclusive, are important insofar as the Army Air Force radio operator is concerned. They are transmitting frequencies and should be memorized thoroughly.

105. Civil control tower.—278 kilocycles is assigned as the civil control tower frequency. Nearly all civil control towers operate on this frequency. The only exceptions are where a congestion of airports exists such as in the vicinity of New York City. In congested areas, other frequencies are assigned to minimize interference.

106. Army control tower.—Army control towers operate on several frequencies which are listed in the Army Air Force radio facility charts. 396 kilocycles is most commonly used.

107. Army air-ground.—4,495 kilocycles is the assigned frequency to be used by Army aircraft. This frequency is strictly an Army Air Force frequency and is not used by other services.

108. National airways.—3,105 kilocycles is the assigned frequency for all itinerant and commercial aircraft. This frequency is occasionally used by Government services insofar as aircraft are con-

cerned. 6,210 kilocycles is a multiple of 3,105 and is authorized for use by nearly all aircraft. This frequency, however, is very seldom used.

109. Radio range.—200 to 400 kilocycles is the band of frequencies assigned to this service.

110. Distress over ocean or Great Lakes.—500 kilocycles is assigned as the international distress frequency over the ocean or Great Lakes. In addition to distress calls, this frequency may be used between ships or aircraft to establish a schedule on other frequencies. All transmissions will be kept to a minimum in this respect.

111. Direction finders.—375 kilocycles is assigned as the direction finder frequency.

112. Army airways.—4,220 kilocycles is assigned as the Army airways frequency.

113. Guarding frequency.—Guarding a frequency means simply to listen continuously to a radio receiver which is tuned to the frequency being guarded. Other names for guarding a frequency might be: Standing a continuous watch; maintaining a continuous watch; standing by on a certain frequency. Listening frequencies should not be confused with transmitting frequencies. A station's frequency is the frequency on which that station will *transmit.*

SECTION XI

FACILITY CHARTS

114. General.—As a visible representation of charted airways, radio facility charts are employed to aid in safety of travel. Each chart covers a specific section of the country, comprising several States. The radio ranges in these areas have been previously plotted and in most cases checked from the air as well as from the ground. Army Air Force radio facility charts and Army Air Force aids to airway flying are reproduced as Handbooks of Instruction, Air Force Technical Order No. 08-15-1 and 08-15-2, for the convenience of Army Air Force personnel. T. O. 08-15-1 contains the radio facility charts and related data; it is revised monthly. T. O. 08-15-2 contains information on airway traffic control areas, civil airways charts,

list of broadcasting stations on the entertainment band, and other information not subject to frequent revision.

115. Weather broadcast schedules.—The weather broadcasting schedules of range stations are placed in the charts on the pages opposite the map section to which they pertain.

116. Number and location of copies.—Copies of T. O. 08-15-1 and T. O. 08-15-2 will be furnished to Army Air Force stations in numbers sufficient to provide one copy per pilot and one copy per copilot of radio equipped aircraft, and one copy per aircraft radio operator.

117. Identification.—Army Air Force radio facility charts will be identified at each station to which issued by placing in the space provided on the front cover the type and call letters of the aircraft to which assigned. In case of copies provided for the use of radio operators, the unit designation will be placed in this space.

118. Inspection.—Commanding officers of Army Air Force stations will cause station technical inspectors to make inspections that will insure that the charts are being corrected as changes are received. The individual making the inspection will enter on the record sheet under the column "Inspected by" the date and his initials.

119. Record of corrections.—A record of correction form has been included on the inside of the front cover of T. O. 08-15-1. The charts will be checked before being placed in service for changes which may have occurred after the date of printing. A record of correction will be maintained on the form and all corrections entered and initialed by the individual concerned.

120. Correcting facility charts.—Corrections on facility charts are made in pencil on the face of the map and on the page preceding the map, using the information contained in the "Weekly Notice to Airmen." This notice to airmen is issued by the Civil Aeronautics Administration each week. Each issue will be thoroughly scanned for any items that affect changes in radio aids, changes of schedules, changes in course alinement, changes in frequency, new installations, etc. In changing course alinement, if the change is 5° or less, the figure indicating the new alinement is sufficient to indicate the change. If the change is more than 5°, a new leg will be drawn in and a wavy line drawn through the old one to show that it no longer exists.

SECTION XII

TABLE NETS

121. General.—After the lecture and classroom discussion on radiotelephone procedure, the class will be divided into groups or nets. Operators will be assigned stations. Each man will act as either the pilot, control tower operator, Army airways operator, or radio range station operator. For practice purposes, the man chosen to act as pilot will first contact the control tower for take-off instructions; next he will contact the Army airways communication station and give position report and make schedule for some later time; and then contact the range stations giving position reports and requesting weather and traffic information at stations ahead. The procedure as outlined in this manual will be observed. A business-like attitude in all contacts will be maintained. The operator must make sure that he knows what he is going to say before beginning; there should be no hesitation in giving reports. If for some reason continuity cannot be maintained, the station being communicated with should be asked to wait. After consolidating the information which is to be transmitted, communication should be continued. Whether a call-up will again be necessary depends upon the length of time off the air. Good judgment here will be the deciding factor.

122. Proficiency in nets.—All stations will maintain a continuous watch during the class period. There will be only two stations in communication with each other at one time. It is up to the other stations listening in to watch for errors in procedure, weather reports, position reports, or any other errors which another station might make. The student discovering the error will notify the net supervisor by raising his hand. The one finding the error will be asked to point out the error and give a correct version of what is to be done. Corrections by other students should not be resented; they are for the benefit of all operators listening in. Any sign of resentment will severely affect the grade in proficiency. All weather reports will be intercepted and copied by all students.

123. Operation.—Operation in the table nets will be assumed to be the same as though one were actually in flight. If what was transmitted is not understood, repetition should be requested over the microphone, not across the table, since actual flight is being simulated.

124. Profanity.—Profanity and obscene language will not be tolerated. Making obscene remarks over the air is a court-martial offense. If it cannot be done over the air, there is no reason for doing it in the table nets. Students will be graded in accordance with what is done and how it is done. (See par. 101.)

125. Practical weather test.—A practical weather test will be given to ascertain ability to copy weather reports. Ability to transmit

and copy such reports using standard symbols should be well developed. Papers, will be graded and the grade received on weather reports will be added to the grades received on table net operation and written examination.

SECTION XIII

STATION LOG

126. General.—*a.* A station log is a running account of station activities to include a record of stations worked and messages handled. This includes position reports, progress reports, flight plans, changes in flight plans, weather reports, frequency, changes in frequency, and any unusual conditions encountered in flight.

b. Form messages such as position or weather reports can easily be copied verbatim when proper procedure and authorized abbreviations are used.

c. Official messages addressed to commanding officers will be copied on a message form and delivered to addressee. A notation that message has been handled will be recorded in log.

d. Figure 9 shows a sample log kept by ship's radio operator.

e. Weather reports are normally copied on a special form provided for the purpose. If none is available plain paper may be used.

f. A sample copy of weather report and form is shown in figure 10.

127. Models.—See figures 9 and 10.

AIRCRAFT RADIO OPERATOR'S LOG

SHIP'S CALL 8506 PILOT Major A. L. Wilson
FREQ 4495 RADIO OPERATOR S. Sgt. D. Marsh
FLIGHT CD to DL via OL DATE Oct 7 1941

TIME C.S.	STN	REMARKS Voice communications
0944	CD	SW LS 0942C 6000 ctc.
0945	LS	SW LS 0944C 6000 ctc. Rcvd wea for
		ZD NS TS. Eabnd 818 5000 passed
		ZD 0930C.
1034	ZD	10 NE ZD 1032C 6000 on top. Rcvd
		wea for ZD NS TS OL.
1135	TS	30 NE TS 1131C 6000 ctc. Rcvd wea
		for OL FV DL.
1224	OL	30 W OL 1222C 6000 ctc, turning SW
		to intercept 5 leg OL rng and
		continue to DL. Rcvd wea for
		OL FV DL.
1300	Ardmore	Onew at 1257C 6000 on top.
1354	OL	15 N DL 1353C 2000 ctc eta Hensley
		1406C. Rcvd wea at DL.
1400	WYO	Sent msg to C.O. Scottfield
		regarding loss of landing flare.
1405	—	Landed at Hensley Field.

FIGURE 9.—Station log.

STATION	TIME OBS.	CEILING IN FT.	SKY	VIS. MILES	WEATHER OBST. TO VIS.	TEMP.	DEW POINT	WIND	ALT. SETTING	REMARKS
ZD	0930C	E20	⊕ ⓪			62	55	→↘11	993	
NS	"	48	⊕260			68	58	→↗12	986	
TS	"		⓪/300			73	57	↘10	997	
ZD	1030C	E20	⊕ ⓪			64	56	→↘10	994	
NS	"	50	⊕250			69	60	→14	987	
TS	"		⓪/			73	57	↘12	998	
OL	"	60	⓪/⓪	7	RW-	73	63	→11	990	
OL	1130C	60	⓪/⓪	7		74	65	→14	991	
FV	"	E30	⓪/250			72	65	→11	978	Ocnl RW-
DL	"	E40	⓪/⓪		RW-	76	61	↗10	981	
OL	1130C	60	⓪/⓪	7		74	65	→14	991	
FV	"	E30	⓪/250			72	65	→11	978	Ocnl RW-
DL	"	E40	⓪/⓪		RW-	76	61	↗10	981	
DL	1330C	30	⓪	4	R -	75	63	→11	982	

FIGURE 10.—Weather report.

ARMY AIR FORCES

APPENDIX I

SYMBOLS OF WEATHER REPORT

1. Weather element symbols.

Symbol	Meaning	Symbol	Meaning
R−	Light rain.	AP−	Light small hail.
R	Moderate rain.	AP	Moderate small hail.
R+	Heavy rain.	AP+	Heavy small hail.
S−	Light snow.	SP−	Light snow pellets.
S	Moderate snow.	SP	Moderate snow pellets.
S+	Heavy snow.	SP+	Heavy snow pellets.
ZR−	Light freezing rain.	T	Thunderstorm.
ZR	Moderate freezing rain.	T+	Heavy thunderstorm.
ZR+	Heavy freezing rain.	SQ−	Mild snow squall.
L−	Light drizzle.	SQ	Moderate snow squall.
L	Moderate drizzle.	SQ+	Severe snow squall.
L+	Heavy drizzle.	RQ−	Mild rain squall.
ZL−	Light freezing drizzle.	RQ	Moderate rain squall.
ZL	Moderate freezing drizzle.	RQ+	Severe rain squall.
ZL+	Heavy freezing drizzle	SW−	Light snow showers.
E−	Light sleet.	SW	Moderate snow showers.
E	Moderate sleet.	SW+	Heavy snow showers.
E+	Heavy sleet.	RW−	Light rain showers.
A−	Light hail.	RW	Moderate rain showers.
A	Moderate hail.	RW+	Heavy rain showers.
A+	Heavy hail.		

NOTE.—The word "tornado" is always written out in full.

2. Obstruction to vision symbols.

Symbol	Meaning	Symbol	Meaning
F—	Damp haze.	BS−	Light blowing snow.
F−	Light fog.	BS	Moderate blowing snow.
F	Moderate fog.	BS+	Thick blowing snow.
F+	Thick fog.	GS−	Light drifting snow.
FF	Dense fog.	GS	Moderate drifting snow.
GF−	Light ground fog.	GS+	Thick drifting snow.
GF	Moderate ground fog.	BD−	Light blowing dust.
GF+	Thick ground fog.	BD	Moderate blowing dust.
GFF	Dense ground fog.	BD+	Thick blowing dust.
H	Hazy (dry haze).	BN−	Light blowing sand.
K−	Light smoke.	BN	Moderate blowing sand.
K	Moderate smoke.	BN+	Thick blowing sand.
K+	Thick smoke.	IF−	Light ice fog.
D−	Light dust.	IF	Moderate ice fog.
D	Moderate dust.	IF+	Thick ice fog.
D+	Thick dust.	IFF	Dense ice fog.

APPENDIX II

CHART OF WIND DIRECTIONS

↓	North.
↓ ↙	Northnortheast.
↙	Northeast.
← ↙	Eastnortheast.
←	East.
← ↖	Eastsoutheast.
↖	Southeast.
↑ ↖	Southsoutheast.
↑	South.
↑ ↗	Southsouthwest.
↗	Southwest.
→ ↗	Westsouthwest.
→	West.
→ ↘	Westnorthwest.
↘	Northwest.
↓ ↘	Northnorthwest.

NOTE.—Arrows fly with the wind.

APPENDIX III

TABLE OF WIND VELOCITY EQUIVALENTS

Descriptive word	Velocity (mph)	Specifications
Calm	Less than 1.	Smoke rises vertically.
	1 to 3	Direction of wind shown by smoke drift but not by wind vanes.
Light	4 to 7	Wind felt on face; leaves rustle; ordinary vane moved by wind.
Gentle	8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
Moderate	13 to 18	Raises dust and loose paper; small branches are moved.
Fresh	19 to 24	Small trees in leaf begin to sway; crested wavelets form on inland waters.
	25 to 31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
Strong	32 to 38	Whole trees in motion; inconvenience felt in walking against the wind.
	39 to 46	Breaks twigs off trees, generally impedes progress.
Gale	47 to 54	Slight structural damage occurs (chimney pots and slate removed).
	55 to 63	Trees uprooted; considerable structural damage occurs.
Whole gale	64 to 75	Rarely experienced; accompanied by widespread damage.
Hurricane	Above 75	

NOTE.—With the exception of "calm," these terms are not to be used in reporting velocity of wind.

Appendix IV

SKY SYMBOLS

A few sky symbols found in weather reports are listed below. It is not practicable to list all the possible combinations that can be made. The study of these symbols will give the student an idea of their composition and method of reporting.

30—⊕/◍	"Ceiling three thousand, high thin overcast, lower broken clouds."
◯25◯	"Scattered, lower scattered clouds at two thousand five hundred."
—◍/15+◯	"High thin broken, lower dark scattered clouds at one thousand five hundred."
40◯	"Scattered clouds at four thousand."
20+⊕	"Ceiling two thousand, dark overcast."
—◯/20+◯	"High thin scattered, lower dark scattered clouds at two thousand."
23◯/◍	"Ceiling two thousand three hundred, high scattered, lower broken clouds."
9⊕2◯	"Ceiling nine hundred, overcast, lower scattered clouds at two hundred."
15⊕+◍	"Ceiling one thousand five hundred, overcast, lower dark broken clouds."
22◍◍	"Ceiling two thousand two hundred, broken, lower broken clouds."
⊕/25◯	"High overcast, lower scattered clouds at two thousand five hundred."
24—◯/◍	"Ceiling two thousand four hundred, high thin scattered, lower broken clouds."
15+◯	"Dark scattered clouds at one thousand five hundred."
32◍/◍	"Ceiling three thousand two hundred, high broken lower broken clouds."

Appendix V

SAMPLE TELETYPE WEATHER REPORTS

RJ E20⊕◍ 135/62/55→↘11/993
LS C SPL 48⊕26◍ 112/68/58→↗12/986
CZ ◍/30◍ 142/73/57↘10/997
KC C E40⊕20◍8 139/66/56→10/993
KL E20⊕◍ 65/55→↘14
KR E35◍ 122/66/57→↘15/988
BN E17◍◍7RW—011/69/59↘9/980
MQ 10◍ 74/60→10
JO SPL ◍/60◍ 078/68/60→13/975/OCNL RW—
PI E30◍25◍ 088/72/59→11/978
ZD SPL 32⊕◍6RW— 102/67/60→↘19—/983
AF E30◍25◍ 125/70/53→↘11/990
NB ◍30◍ 74/54↘22—/LWR ◍V◍
PS C E50◍ 119/85/61→28+/989
SO E40◍/◍RW— 091/76/61↗11/981
NA C E50◍◍ 091/82/57→↗22—/982
AG C —◍/20◍ 122/74/66→↗13/933/◍V◍
CG C SPL E70◍18◍8 071/68/60→↗8/973
MH —⊕/50◍ 196/64/48↑↗23—/011
CA E60—⊕/◍ 210/61/45↑↗20—/013
HA —◍/4H 312/50/32↑↗14/041
PT N —◍/11/2K— 325/51/29↑↗11/045
RF ○8 356/43/31↑7/053

Appendix VI

PHRASEOLOGY FOR STATING NUMBERS

1. Time.

AM	PM	Statement	AM	PM	Statement
12:01		Zero zero zero one.		6:00	One eight zero zero.
12:25		Zero zero two five.		9:20	Two one two zero.
6:00		Zero six zero zero.		11:50	Two three five zero.
	12:20	One two two zero.		12:00	Zero zero zero zero.
	3:02	One five zero two.			

2. Ceiling.

Feet	Statement	Feet	Statement
700	Seven hundred.	2, 400	Two thousand four hundred.
1, 000	One thousand.	2, 700	Two thousand seven hundred.
1, 200	One thousand two hundred.	3, 300	Three thousand three hundred.
1, 500	One thousand five hundred.	4, 600	Four thousand six hundred.
2, 000	Two thousand.		

3. Altitude of field.

Feet	Statement	Feet	Statement
10	Field elevation one zero.	1, 850	Field elevation one eight five zero.
75	Field elevation seven five.		
582	Field elevation five eight two.	2, 749	Field elevation two seven four nine.
600	Field elevation six hundred.		
744	Field elevation seven four four.	6, 382	Field elevation six three eight two.

4. Altimeter setting.

Setting	Statement	Setting	Statement
28:00	Two eight zero zero.	29:54	Two nine five four.
28:03	Two eight zero three.	30:96	Three zero nine six.
29:09	Two nine zero nine.		

5. Altitude in position reports.

Feet	Statement	Feet	Statement
2, 000	Two thousand.	6, 000	Six thousand.
3, 000	Three thousand.	10, 000	Ten thousand.
4, 000	Four thousand.	11, 000	Eleven thousand.
5, 000	Five thousand.	12, 000	Twelve thousand.

APPENDIX VII

STANDARD LIGHT SIGNALS—CONTROL TOWER

1. The following light signals are prescribed for use by pilots:

a. While airplane is in flight:

Green light	Cleared to land.
Red light	Do not land. Stay clear of field and continue circling.

b. While airplane is taxiing:

Green light	Continue taxiing.
Flashing red light	Return to hangar line.
Red light	Stop immediately.

c. While airplane is in take-off position:

Green light	Clear to take off.
Flashing red light	Return to hangar line.
Red light	Do not take off, wait.

2. If a pilot desires to land at night, he will turn on his landing lights. The tower will acknowledge this signal by use of light signals as outlined above. A series of flashes of the landing lights will indicate that—

a. If the floodlight is on, the pilot wants it turned off.

b. If the floodlight is off, the pilot wants it turned on.

Appendix VIII

ABBREVIATIONS AND PHRASE CONTRACTIONS

ABNDC	abundance
ABNDT	abundant
ABNML	abnormal
ABRD	aboard
ABSB	absorb
ABT	about
ABV	above
AC	altocumulus
ACC	altocumulus castellatus
ACCT	account
ACELT	accelerate
ACFT	aircraft
ACK	acknowledge
ACMLT	accumulate
ACPT	accept
ACPY	accompany
ACRS	across
ACTG	acting
ACTN	action
ACTV	active
ADJN	adjoin
ADJT	adjacent
ADN	addition
ADQT	adequate
ADRNDCK	Adirondack
ADS	address
ADVC	advice
ADVN	advance
ADVR	adverse
ADVZ	advise
ADVZY	advisory
AERLGL	aerological
AERLY	aerology
AERNL	aeronautical
AFCT	affect
AFDK	after dark
AFP	alternate flight plan
AFT	after
AFTN	afternoon
AGN	again
AGRSV	aggressive
AHD	ahead
ALA	Alabama
ALF	aloft
ALG	along
ALGHNY	Alleghany
ALSK	Alaska
ALT	altitude
ALTA	Alberta
ALTF	alternate field
ALTN	alternate
ALUTN	Aleutian
AM	ante meridian
AMAFA	air mass and frontal analysis
AMGT	amalgamate
AMS	air mass
AMT	amount
ANCPT	anticipate
ANLGS	analogous
ANLYS	analysis
ANLZ	analyze
ANS	answer
ANT	antenna
ANTHR	another
APCH	approach
APLCHN	Appalachian
APOBS	airplane weather observations
APPR	appear
APRT	apparent
APRX	approximate
APV	approve
ARBTY	arbitrary
ARIZ	Arizona
ARK	Arkansas
ARND	around
ARNG	arrange
ARV	arrive
AS	altostratus
ASCD	ascend
ASGN	assign
ASM	assume
ASMN	assumption
ASOCT	associate
ASSAP	as soon as practicable
ATC	airway traffic control
ATCH	attach
ATLC	Atlantic
ATND	attend
ATSPH	atmosphere
ATT	American Telephone & Telegraph Company
AUG	August
AUGRA	authority granted
AURBO	Aurora Borealis

AUTO	automatic
AUX	auxiliary
AUZRE	authority is requested
AVE	average
AVL	avail
AWEA	account weather
AWO	airways weather office
AWY	airway
BAG	baggage
BAL	Bowen Airlines
BC	British Columbia
BCFT	Beechcraft
BCM	become
BCN	beacon
BDC	broadcast
BDR	border
BEBNR	beacon light burning but not revolving
BENBU	beacon light not burning
BFR	before
BGN	begin
BL	bill of lading
BLC	balance
BLD	build
BLK	black
BLKT	blanket
BLP	bomber landplane
BLST	ballast
BLW	blow
BME	Boston Maine Airways
BND	bound
BNDRY	boundary
BNF	Braniff Airways
BNTH	beneath
BOIG	Boeing
BRD	board
BRGT	bright
BRK	break
BRKN	broken
BRKSHR	Berkshire
BRM	barometer
BRMC	barometric
BRONO	broadcast not operating
BROOK	broadcast resumed operation
BSP	bomber seaplane
BTR	better
BTWN	between
BULET	bureau letter
BYD	beyond
CAA	Civil Aeronautics Administration
CAL	Columbia Airlines
CALIF	California
CAN	Canada
CAP	cleared as planned
CAPT	captain
CASCDS	Cascades
CAVU	ceiling and visibility unrestricted
CB	cumulonimbus
CC	cirrocumulus
CFM	confirm
CFN	confine
CHG	change
CHSPK	Chesapeake
CHTR	charter
CI	cirrus
CIG	ceiling
CIR	circular
CK	check
CKT	circuit
CLB	climb
CLD	cloud
CLR	clear
CLZ	close
CM	cumulonimbus mammatus (mammatocumulus)
CMNC	commence
CMPS	compass
CMPT	compartment
CMRC	commerce
CNA	Canadian Airways
CNCL	cancel
CND	condition
CNDN	Canadian
CNT	connect
CNTR	center
CNTRL	central
CO	commanding officer
CO	company
COL	colonel
COLO	Colorado
COMDR	commander
COMDT	commandant
COMP	complete
CONN	Connecticut
CONST	construct
CONT	continue

]OREQ	confirming requisition follows
]ONTDVD	Continental Divide
]PTY	capacity
]PZ	compose
]QN	correction
]QT	correct
]RC	circle
]RS	course
]RZ	cruise
]S	central standard (time)
]S	cirrostratus
]SA	Chicago & Southern airways
]SDR	consider
]ST	coast
]TC	contact
]TL	control
]TN	caution
]TSKLS	Catskills
]U	cumulus
]VA	Central Vermont Airways
]VR	cover
]YL	cylinder
DABRK	daybreak
DAL	Delta Airlines
DALGT	daylight
DBL	double
DBT	doubt
DBTF	doubtful
DC	District of Columbia
DCLN	decline
DCRS	decrease
DEC	December
DEL	Delaware
FANOT	fan type marker inoperative
FAROK	fan type marker resumed normal operation.
FC	fractocumulus
FCLD	Fairchild
FCST	forecast
FCTY	factory
FEB	February
FED	federal
FELT	familiarization flight
FILLI	field and lighting facilities
FINAC	field notice to airmen is current
FLA	Florida
FLD	field
FLC	failing
FLP	fighter landplane
FLRY	flurry
FLT	flight
FLW	follow
FORNN	forenoon
FPLN	flight plan
FPM	feet per minute
FQCY	frequency
FQT	frequent
FRI	Friday
FRM	form
FRSH	fresh
FRST	frost
FRZ	freeze
FRZN	frozen
FS	fractostratus
FSP	fighter seaplane
FT	feet; foot; fort
FTHR	farther; further
FTNX	full tanks
FVR	favor
FWD	forward
GA	Georgia
GAL	gallon
GAS	gasoline
GAT	Gorst Air Transport
GBA	give better address
GND	ground
GNDFG	ground fog
GNRL	general
GOVT	Government
GRDL	gradual
GRT	great
GST	gust
HD	head
HDQRTRS	headquarters
HDWND	headwind
HI	high
HIWA	highway
HLD	hold
HLF	half
HMD	humid
HND	hundred
HNG	hang
HR	hour

HRZN	horizon
HURCN	hurricane
HVY	heavy
HYDRO	hydrographic
HZY	hazy
MD	Maryland
MDT	moderate
ME	Maine
METGL	meteorological
MICH	Michigan
MID	middle
MIDN	midnight
MIN	minute
MINN	Minnesota
MISG	missing
MISS	Mississippi
ML	mail
MLD	mild
MNTN	maintain
MO	Missouri
MON	Monday
MONT	Montana
MOV	move
MPH	miles per hour
MRKR	marker
MRNG	morning
MRTM	maritime
MS	mountain standard (time)
MSG	message
MSL	mean sea level
MST	most
MSTK	mistake
MSTR	moisture
MTN	mountain
MXD	mixed
NACOS	National Communication Schedule
NAV	navigation
NC	North Carolina
ND	North Dakota
NEB	Nebraska
NEC	necessary
NEV	Nevada
NGT	night
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NO	number
NOBND	northbound
NORDO	no radio
NOTAM	notice to airmen
NOV	November
NRML	normal
NS	nimbostratus
NVR	never
NXT	next
NY	New York
OBS	observe
OBSC	obscure
OBST	obstruct
OCLD	occlude
OCN	occasion
OCT	October
OHIO	Ohio
OKLA	Oklahoma
PCPN	precipitation
RAOBS	radiometrograph observations
RANOT	radio range not operating
RCH	reach
RCKY	rocky
RCMD	recommend
RCV	receive
RDG	ridge
RDO	radio
RE	reference
REG	register
REQ	request
RFL	refuel
RFS	refuse
RGD	ragged
RGLR	regular
RGLT	regulate
RGN	region
RGT	right
RI	Rhode Island
RLA	relay
RLS	release
RMD	remind
RMN	remain
RMRK	remark
RMV	remove
RNG	range
RNWY	runway
RPD	rapid
RPL	replace
RPRT	report
RPT	repeat
RQN	requisition
RQR	require

RR	railroad
RSG	rising
RSN	risen
RSV	reserve
RSVN	reservation
RTE	route
RTN	return
RUF	rough
RUTEL	reference telegram from your office
RVR	river
RYRQD	reply requested
SASK	Saskatchewan
SAT	Saturday
SBSD	subside
SC	South Carolina
SC	stratocumulus
SCT	scatter
SCTR	sector
SD	South Dakota
SEC	second
SEP	September
SEQ	sequence
SFC	surface
SFCT	sufficient
SGST	suggest
SGT	sergeant
SHFT	shift
SHLW	shallow
SHWR	shower
SIERNEV	Sierra Nevada
SIG	signature
SISKY	Siskiyou
SIT	situate
SKJ	schedule
SLGT	slight
SLP	scout landplane
SLT	sleet
SLW	slow
SMRY	summary
SMTM	sometime
SMWHT	somewhat
SNGL	single
SNW	snow
SOBND	southbound
SP	seaplane
SPEC	specification
SPKL	sprinkle
SPL	special
SPRD	spread
SPT	separate
SQAL	squall
SQDN	squadron
SRCH	search
SRND	surround
SRS	see our service
SSP	scout seaplane
ST	stratus; street; saint
STA	State
STG	strong
STL	settle
STM	stern
STN	station
STP	stop
STRSPH	stratosphere
STSN	Stinson
STWD	steward
SUN	Sunday
SUNRS	sunrise
SUNST	sunset
SUPR	superior
SUPT	superintendent
SUREQ	submit requisition
SVC	service
SVR	severe
SVRL	several
SXN	section
SYS	see your service
TDA	today
TELNO	telegraph (radio) communications interrupted
TELOK	telegraph (radio) communications resumed
TELRY	telegraph reply
TENN	Tennessee
TERM	terminate
TEX	Texas
TFK	traffic
THD	thunderhead
THDR	thunder
THK	thick
THN	thin
THRFTR	thereafter
THRU	through
THRUT	throughout
THSD	thousand
THTN	threaten
THU	Thursday
TKOF	tak(ing) off
TKT	ticket
TLFO	telephone

TLP	transport landplane
TLTP	teletype
TMP	temperature
TMW	tomorrow
TNCY	tendency
TNGT	tonight
TNTV	tentative
TOVC	top of overcast
TPG	topping
TRML	terminal
TRPAT	tropical Atlantic
TRPGU	tropical Gulf
TRPMA	tropical maritime
TRPPA	tropical Pacific
TRTY	territory
TSATLC	trans-Atlantic
TSFR	transfer
TSFRM	transform
TSHER	thundershower
TSLPOL	transitional polar
TSLPOLAT	transitional polar Atlantic
TSLPOLCO	transitional polar continental
TSLPOLPA	transitional polar Pacific
TSLTRPAT	transitional tropical Atlantic
TSLTRPGU	transitional tropical Gulf
TSLTRPMA	Transitional tropical maritime
TSLTRPPA	Transitional tropical Pacific
TSMT	Transmit
TSP	Transport seaplane
TSPAC	trans-Pacific
TSPT	transport
TSTM	thunderstorm
TUE	Tuesday
TURBO	turbulence
TURBT	turbulent
TWA	Transcontinental & Western Air, Inc.
TWD	toward
TWIZN	twilight zone
TYPNO	teletype communications interrupted
TYPOK	teletype communications resumed
UAL	United Airlines
ULP	utility landplane
UNAB	unable
UNEC	unnecessary
UNL	unlimited
UNR	unraisc
UNRD	unread
UNSTDY	unsteady
UNSTL	unsettle
UNUSL	unusual
UPWD	upward
UQOT	unquote
URNWY	use runway
US	United States
USP	utility seaplane
UTAH	Utah
VA	Virginia
VAT	Varney Air Transport
VCNTY	vicinity
VEGA	Vega
VEL	velocity
VFY	verify
VLNC	violence
VLNT	violent
VLY	valley
VPR	vapor
VRBL	variable
VRG	veering
VSB	visible
VSBY	visibility
VSN	vision
VT	Vermont
WACO	Waco
WASH	Washington
WAT	Watertown Airways
WBTS	whereabouts
WD	word
WEA	weather
ZONOT	zone marker inoperative

Appendix IX

TELETYPE DESIGNATORS

AB	Albuquerque, N. Mex.
AF	Advance, Mo.
AG	Atlanta, Ga. (Candler Field).
AH	Alameda, Calif.
AI	Agua Caliente, Mex.
AJ	Alma, Ga.
AK	Acomita, N. Mex.
AL	Arlington, Oreg.
AM	Ann Arbor, Mich.
AP	Abilene, Tex.
AR	Auburn, Calif.
AS	Anderson, S. C.
AT	Ardmore, Okla.
AU	Appleton, Wis.
AV	Adairsville, Ga.
AW	Augusta, Maine.
AY	Anthony, Kans.
AZ	Albany, N. Y.
BA	Beowawe, Nev.
BB	Bangor, Maine.
BD	Bakersfield, Calif.
BE	Boise, Idaho.
BF	Bellefonte, Pa.
BG	Bigg Springs, Nebr.
BH	Birmingham, Ala.
BI	Billings, Mont.
BJ	Buffalo, N. Y.
BL	Belgrade, Mont.
BO	Baltimore, Md.
BQ	Buckstown, Pa.
BR	Brookville, Pa.
BU	Burbank, Calif.
BZ	Big Spring, Tex.
CA	Columbia, Mo.
CB	Chattanooga, Tenn.
CC	Cincinnati, Ohio.
CD	Scott Field, St. Louis, Mo.
CG	Chicago, Ill.
CJ	Chesterfield, Tenn.
CM	Cambridge, Ohio.
CN	Concord, N. H.
CO	Columbus, Ohio.
CR	Corpus Christi, Tex.
CS	Charleston, S. C.
CT	Castle Rock, Wash.
CU	Custer, Mont.
CV	Cleveland, Ohio.
CW	Casper, Wyo.
CX	Cassoday, Kans.
CZ	Chanute, Kans.
DB	Daytona Beach, Fla.
DF	Dryden, Tex.
DG	Daggett, Calif.
DH	Duluth, Minn.
DJ	Del Monte, Calif.
DK	Dunkirk, N. Y.
DL	Dallas, Tex.
DM	Des Moines, Iowa.
DO	Detroit, Mich., City Airport.
DP	DuPont Airport, Wilmington, Del.
DT	Detroit, Mich., Wayne County Airport.
DV	Denver, Colo.
DW	Dawson, N. Dak.
DX	Davenport, Iowa (Cram Field).
DY	Vandalia, Ohio.
DZ	DuBois, Idaho.
EA	Elmira, N. Y.
EF	Effingham, Ill.
EG	Elgin, Ill.
EK	Elkins, W. Va.
EM	El Morro, N. Mex.
EO	El Paso, Tex.
ER	Erie, Pa.
EV	Evansville, Ind.
EY	Elk City, Okla.
EZ	East Liverpool, Ohio.
FD	Frederick, Md.
FF	Spring Bluff, Mo.
FG	Pittsfield, Mass.
FH	Red Bluff, Calif.
FI	Fort Sill, Okla.
FJ	Fort Jones, Calif.
FK	Ashford, Ariz.
FM	Fort Myers, Fla.
FN	Flint, Mich.
FO	Fargo, N. Dak. (Hector Field).
FP	Fort Plain, N. Y.
FR	Fort Smith, Ark.
FS	Forsyth, Mont.
FT	Fresno, Calif. (Chandler Field).
FV	Fort Worth, Tex.
FW	Fort Wayne, Ind.
FX	Fontana, Calif.
FY	Fort Riley near Salina, Kans.
FZ	Front Royal, Va.
GA	Golva, N. Dak.
GE	Gainesville, Tex.
GF	Grand Forks, N. Dak.
GI	Grand Island, Nebr.
GJ	Gordonsville, Va.
GO	Goshen, Ind.
GP	Guadalupe Pass, Tex.

GR	Grand Rapids, Mich.
GS	Galveston, Tex.
GW	Greensboro, N. C.
HA	Hayesville, Ohio.
HC	Hager City, Wis.
HF	Hatbox Field, Okla.
HO	Hamilton Field, Calif.
HT	Hartford, Conn.
HU	Houston, Tex.
HX	Harrisburg, Pa.
HY	Hensley Field, Ft. Worth, Tex.
IB	Caribou, Maine.
IC	Wenatchee, Wash.
ID	Indianapolis, Ind.
II	Roosevelt Field, N. Y.
IN	Indio, Calif.
JA	Jackson, Miss.
JG	Burlington, Vt.
JH	Bar Harbor, Maine.
JI	Brownsville, Tex.
JM	Jamestown, N. Dak.
JN	Jackson, Mich.
JO	Joliet, Ill.
JP	Joplin, Mo.
JR	Baton Rouge, La.
JS	Santa Ana, Calif.
JX	Jacksonville, Fla.
KC	Kansas City, Mo.
KF	Kelly Field, Tex.
KG	Kingston, Calif.
KL	Knoxville, Mo.
KM	Camden, N. J.
KN	Charleston, W. Va.
KR	Kirksville, Mo.
KV	Coffeyville, Kans.
KW	Key West, Fla.
KX	Knoxville, Tenn.
KZ	Kalamazoo, Mich.
LA	Los Angeles, Calif.
LB	Lynchburg, Va.
LC	Lake Charles, La.
LD	Selfridge Field, Mich.
LE	LaCrosse, Wis.
LF	Lafayette, Ind.
LG	New York, N. Y.
LI	Little Rock, Ark.
LJ	Lansing, Mich.
LK	Lone Rock, Wis.
LM	Livermore, Calif.
LN	Lebo, Kans.
LP	Lakehurst, N. J.
LQ	Las Vegas, Nev.
LR	Laramie, Wyo.
LS	St. Louis, Mo.
LT	Livingston, Mont.
LV	Louisville, Ky.
LY	Langley Field, Va.
MA	Madison, Wis.
MD	Milford, Utah.
MF	Medford, Oreg.
MH	Marshall, Mo.
MK	Milwaukee, Wis.
MM	Miami, Fla.
MO	Moline, Ill.
MP	Minneapolis, Minn.
MS	Mobile, Ala.
MV	Milroy, Ind.
MZ	Montezuma, Iowa.
NA	Nashville, Tenn.
NC	Pensacola, Fla.
NF	New Florence, Mo.
NK	Newark, N. J.
NL	Nogales, Ariz.
NO	New Orleans, La.
NQ	North Platte, Nebr.
NR	Norfolk, Va.
NT	Navasota, Tex.
NU	Chanute Field, Ill.
NX	New Hackensack, N. Y.
NZ	Mormon Mesa, Nev.
OA	Oakland, Calif.
OC	Oceanside, Calif.
OD	Modesto, Calif.
OH	Omaha, Nebr.
OL	Oklahoma City, Okla.
ON	Sloan Field, Tex.
OP	Pope Field, Ft. Bragg, N. C.
OS	Oshkosh, Wis.
OT	Otto, N. Mex.
OX	Biloxi, Miss.
PB	Pembina, N. Dak.
PD	Portland, Oreg.
PG	Philadelphia, Pa.
PH	Phoenix, Ariz.
PI	Peoria, Ill.
PK	Patterson Field, Dayton, Ohio.
PQ	Pocatello, Idaho.
PR	Providence, R. I.
PS	Memphis, Tenn.
PT	Pittsburgh, Pa.
PU	Pueblo, Colo.
RA	Raleigh, N. C.
RC	Rochester, N. Y.
RD	Rockford, Ill.
RK	Bismarck, N. Dak.
RM	Richmond, Ind.
RN	Akron, Colo.
RO	Roanoke, Va.
RP	Reno, Nev.
RQ	Rock Island, Ill.

RV	Riverside, Calif.
RW	Richmond, Va.
SA	Seattle, Wash.
SD	Sidney, Nebr.
SF	San Francisco, Calif.
SL	Salt Lake City, Utah.
SM	Spokane, Wash.
SN	South Bend, Ind.
SO	Smiths Grove, Ky.
SQ	San Diego, Calif.
SR	Syracuse, N. Y.
SU	Spartanburg, S. C.
SW	Moffett Field, Calif.
SX	Salem, Oreg.
SZ	Sacramento, Calif.
TA	Tacoma, Wash.
TC	Tucumcari, N. Mex.
TD	Trinidad, Colo.
TF	Scotts Bluff, Nebr.
TH	Terre Haute, Ind.
TJ	Tallahassee, Fla.
TK	Tarkio, Mo.
TL	Toledo, Ohio.
TM	Tampa, Fla.
TN	Trenton, N. J.
TO	Topeka, Kans.
TR	Texarkana, Tex.
TS	Tulsa, Okla.
TU	Tuscaloosa, Ala.
TV	Tyler, Tex.
TW	Twin Falls, Idaho.
TY	Tylertown, Miss.
TZ	Tucson, Ariz.
UA	Utica, N. Y.
UB	Alhambra, Calif.
UG	Montgomery, Ala.
UH	Plymouth, Utah.
UK	Muskegon, Mich.
UP	Palm Springs, Calif.
US	Pulaski, Va.
VD	Augusta, Ga.
VG	Parkersburg, W. Va.
VH	Las Vegas, N. Mex.
VS	Vicksburg, Miss.
WA	Washington, D. C.
WC	Waco, Tex.
WD	Wichita, Kans.
WM	Mitchel Field, N. Y.
WO	Winslow, Ariz.
WP	Wink, Tex.
WU	Watertown, S. Dak.
WAB	Aberdeen, Md.
WBF	Bolling Field, Washington, D. C.
WBL	Fort Bliss, El Paso, Tex.
WBR	Brooks Field, San Antonio, Tex.
WCN	Schoen Field, Ft. Benj. Harrison, Indianapolis, Ind.
WDF	Duncan Field, San Antonio, Tex
WFC	Fort Crockett, Galveston, Tex.
WFL	Fort Lewis, Tacoma, Wash.
WKS	Barksdale Field, Shreveport, La.
WMT	Middletown, Pa. (Olmstead Field).
WMZ	March Field, Calif.
WLY	Lowry Field, Denver, Colo.
WBG	Biggs Field, El Paso, Tex.
WOF	Offutt Field, Ft. Cook, Omaha, Nebr.
WRA	Randolph Field, San Antonio, Tex.
WRD	Fairfax Field, Kansas City, Kans.
WST	Stout Field, Indianapolis, Ind.
WWF	Wright Field, Dayton, Ohio.
XA	Allentown, Pa.
XN	Austin, Tex.
XW	Maxwell Field, Montgomery, Ala.
XBF	Bolling Field, D. C.
XCD	Scott Field, St. Louis, Mo.
XHO	Hamilton Field, San Francisco, Calif.
XLD	Selfridge Field, Detroit, Mich.
XLY	Langley Field, Hampton, Va.
XMZ	March Field, Riverside, Calif.
XNU	Chanute Field, Rantoul, Ill.
XPK	Patterson Field, Dayton, Ohio.
XRD	Fairfax Field, Kansas City, Kans.
XSW	Moffett Field, Sunnyvale, Calif.
XWM	Mitchel Field, Long Island, N.Y.
YA	Yakima, Wash.
YC	Calgary, Alta.
YH	Blythe, Calif.
YL	Sioux Falls, S. Dak.
ZD	Springfield, Ill.
ZE	San Jose, Calif.
ZF	Springfield, Mo.
ZH	Shreveport, La.
ZK	Santa Fe, N. Mex.
ZN	San Antonio, Tex.
ZP	St. Paul, Minn.

APPENDIX X

PHONETIC ALPHABET

Letter	Spoken as	Letter	Spoken as	Letter	Spoken as
A	AFIRM	J	JIG	S	SAIL
B	BAKER	K	KING	T	TARE
C	CAST	L	LOVE	U	UNIT
D	DOG	M	MIKE	V	VICTOR
E	EASY	N	NEGAT	W	WILLIAM
F	FOX	O	OPTION	X	XRAY
G	GEORGE	P	PREP	Y	YOKE
H	HYPO	Q	QUEEN	Z	ZED
I	INTER*	R	ROGER		

*For joint Army-Navy communications, the letter I is represented by "Interrogatory."

Numeral	Spoken as	Numeral	Spoken as
0	ZE-RO	5	FI-YIV
1	WUN	6	SIKS
2	TOO	7	SEV-VEN
3	THUR-REE	8	ATE
4	FO-WER	9	NI-YEN

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[A. G. 062.11 (1-16-42).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

Bn and H1(6), 2, 4–7, 17(5); IC 11(5).

(For explanation of symbols see FM 21–6.)

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